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FAUNAL AREAS IN SOUTHERN ARIZONA

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A HERPETOLOGICAL CONSIDERATION OF
FAUNAL AREAS IN SOUTHERN ARIZONA*

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HOWARD K. GLOYD

Director, The Chicago Academy of Sciences

Numerous publications have dealt with various features of the herpetology of Arizona but no attempt seems to have been made to correlate the distribution of amphibians and reptiles with the more general environmental conditions of the region. The only truly ecological study of these vertebrates in Arizona is that of Ruthven (1907) in which many valuable data are recorded but emphasis is placed on local habitat distribution in the vicinity of Tuscon. The many other publications on Arizona herpetology, although more or less replete with useful records of the occurrence of various species, contain little ecological information. The students of mammals and birds, on the other hand, have made more progress toward an analysis of the general environmental factors which influence animal distribution, and Arizona has had its share of attention.

My interest in this problem is chiefly an outgrowth of observations and collections made in the Southwest during the summers of 1930 and 1931. Subsequently I have examined a considerable number of additional specimens, assembled as much information as opportunities permitted on the distribution of Arizona reptiles, reviewed the literature on the vertebrates of southern Arizona and adjacent territory, and compiled some data on certain climatological and physiographical features of the region. On the basis of these considerations and my own observations in the field, I propose to define, provisionally, three so-called faunal areas of southern Arizona, and to place on record in the form

* Contribution from the Department of Zoology, University of Michigan.

of an annotated list of species certain herpetological notes which may be useful to those interested in the vertebrates of the region.

The collections which form the basis of this study were made in the region south of the Gila River for the Museum of Zoology, University of Michigan, and consist of approximately 1150 specimens representing 56 species and subspecies distributed among the various groups as follows: amphibians 8, lizards 27, snakes 19, and turtles 2. In addition to these I have examined the Arizona specimens in the Carnegie Museum, a considerable amount of material in the U. S. National Museum, and numerous snakes and lizards received from friends and correspondents in Arizona. The annotated list is limited to species actually collected on the two expeditions or subsequently received as gifts to the Museum. Routes traveled and principal collecting stations will be described in a later section.

To President Alexander G. Ruthven and Mrs. Helen T. Gaige of the University of Michigan I am greatly indebted for making these expeditions possible. In 1930 Dr. Hobart M. Smith, then a student at the Kansas State College, Manhattan, was a member of the field party throughout the entire season and to his energy and skill as a collector are due many valuable specimens. Mr. W. H. Ditzler of Peru, Indiana, with his family joined the party in July, giving efficient and much-appreciated help in the Huachuca Mountains and in the Cañada del Oro. In 1931 Mr. Wilbur Doudna, a graduate student in forestry at the University of Michigan, accompanied us as far as Willcox, Arizona, where he collected in the Sulphur Springs Valley and the Chiricahua Mountains.

For many courtesies extended to us while we were in the field, I wish to express sincere appreciation to the following residents of Arizona: Captain H. M. Rose, Adjutant, Fort Huachuca; Mr. William Miller, U. S. Customs Inspector, Ajo; Deputy Sheriff Victor Gael and Mrs. Madeline R. Spain, Wellton; Mr. Leslie Wilcox, Hereford; Mr. and Mrs. Andrew Hood, Ramsey Cañon, Huachuca Mountains; Mr. and Mrs. A. H. Jelley and Mr. W. B. Covey, Willcox; and Mr. and Mrs. T. W. Bentley, Turkey Creek Ranger Station, Chiricahua Mountains. The officials of the Arizona Game and Fish Commission, particularly Messrs. R. L. Bayless, K. H. Pierson and S. L. Lewis, have cordially assisted us in every possible way.

Mr. M. Graham Netting of the Carnegie Museum, Pittsburgh, Pennsylvania, has kindly loaned for comparison and study the entire series of Arizona amphibians and reptiles under his care, and Dr. Leonard Stejneger and Dr. Doris M. Cochran have cordially provided facilities for examination of specimens in the U. S. National Museum. Additional Arizona specimens have been received from Mr. Earl

Sanders, Mesa, Arizona, Mr. P. C. Bowman, Warren, Arizona, Dr. R. H. Painter, Kansas State College, Manhattan, Kansas, and Mr. Philip Blossom, University of Michigan.

Dr. Frank N. Blanchard and Mrs. Helen T. Gaige of the University of Michigan have given critical suggestions concerning matters of nomenclature and assistance in the identification of certain specimens. Finally, I wish to acknowledge my indebtedness and express my appreciation to my wife, Leonora K. Gloyd, who has shared in all the field work and has been inestimably helpful throughout the preparation of this report.

GENERAL FEATURES OF THE REGION

In the portion of Arizona which lies south of the Gila River, the lowlands may be characterized as a series of alluvial-plain valleys ranging in elevation from between 4000 and 5000 feet in the San Simon, Sulphur Springs, and San Pedro Valleys of the east to less than 200 feet above mean sea level in the Yuma Desert of the extreme south-west.* The lowland plains of Cochise, Santa Cruz, and extreme eastern Pima Counties support a grassland type of vegetation and are suitable for grazing, while to the westward of the Santa Catalina and Santa Rita Mountains the plains of the Papago Country contain only desert chaparral.

Separating these valleys at frequent intervals are numerous small mountain ranges, running mostly in a north and south direction (fig. 1), and of greatest extent and elevation in the eastern region where in east-central Cochise County an altitude of 9,795 feet is reached by Chiricahua Peak. These eastern mountains, especially the Chiricahua, Dragoon, Santa Catalina, Huachuca, Santa Rita, and Tumacacori groups of Cochise, Pima, and Santa Cruz Counties, receive enough rainfall to support a considerable growth of coniferous trees and a few species of hardwoods. All of the above mentioned ranges are included in the Coronado National Forest. The mountains to the westward, however, are the so-called "dead ranges", composed chiefly of igneous rocks, almost completely barren of vegetation and seldom with an elevation over 5000 feet, the average being between 3000 and 4000 feet.

In the region as a whole high temperature and low rainfall are the most outstanding features of the climate but there is much variation in these conditions between the extremes of the western and eastern portions. The averages of mean temperatures at certain stations for the

* Elevations from N. H. Darton's Topographical Map of the State of Arizona, 1923; Arizona Bureau of Mines in cooperation with the U. S. Geological Survey.

TABLE I. Averages of Mean Temperatures, in Degrees Fahrenheit, by Months, Seasons and Annually for Years between 1915 and 1930 at Certain Stations in Southern Arizona.

Station	Altitude	No. of Years of Record	Dec.	Jan.	Feb.	Winter	Mar.	Apr.	May	Spring	June	July	Aug.	Summer	Sept.	Oct.	Nov.	Fall	Annual
Yuma.....	141	16	54.9	53.8	59.8	56.1	62.8	69.6	76.4	69.6	85.5	91.4	90.0	88.9	84.2	72.7	61.8	72.9	72.0
Gila Bend.....	737	8	54.1	52.6	56.1	54.3	62.4	67.5	75.5	68.4	86.7	92.7	90.5	89.9	84.5	73.3	60.3	72.7	71.5
Ajo.....	1,805	16	53.5	52.0	56.4	53.9	60.8	67.8	75.6	68.0	85.6	89.0	87.7	87.4	83.4	72.8	61.4	72.5	70.5
Tucson.....	2,400	16	50.3	49.6	53.6	51.1	56.9	62.7	71.4	63.6	80.8	85.1	82.8	82.9	78.5	68.3	57.3	68.0	61.5
Ft. Huachuca..	5,000	3	50.9	44.9	44.7	46.8	51.8	58.0	64.4	58.0	75.6	75.3	76.4	75.7	72.0	65.9	54.6	64.1	61.5
Douglas.....	3,930	15	45.2	45.0	49.8	46.6	50.3	60.2	68.1	59.5	77.7	79.7	77.6	78.1	73.7	63.7	52.3	63.2	62.3

TABLE II. Average Rainfall in Inches by Months, Seasons and Annually for the Period between 1915 and 1930 at Certain Stations in Southern Arizona.

Station	Altitude	No. of Years of Record	Dec.	Jan.	Feb.	Winter	Mar.	Apr.	May	Spring	June	July	Aug.	Summer	Sept.	Oct.	Nov.	Fall	Annual
Yuma.....	141	16	.66	.53	.14	.44	.25	.09	.02	.12	.01	.18	.49	.23	.72	.22	.11	.35	3.42
Gila Bend.....	737	10	.55	.97	.41	.64	.62	.17	.20	.33	.06	.77	1.14	.65	.70	.16	.33	.39	6.10
Ajo.....	1,805	16	.98	.92	.58	.83	.72	.42	.16	.43	.06	1.68	1.74	1.16	.88	.30	.59	.59	9.48
Tucson.....	2,400	16	.80	.89	.72	.80	.85	.50	.22	.52	.32	2.23	1.82	1.46	1.55	.44	.83	.94	11.30
Ft. Huachuca..	5,000	9	.34	1.36	.54	.74	.66	.32	.30	.46	.56	5.12	3.38	3.02	1.24	.28	.64	.72	14.76
Douglas.....	3,930	16	.62	.72	.43	.59	.45	.30	.23	.32	.44	3.85	2.39	2.23	1.56	.73	.67	.97	12.27

years between 1915 and 1930 are given in Table I, and the average rainfall for the same stations during the same period in Table II. The summer heat is intense and in the desert lowlands of the lower Gila Valley, at Yuma and Gila Bend, temperatures higher than 100°F. occur frequently and such extremes as 119° and 121° sometimes are recorded (see Table III). In this area killing frosts rarely if ever occur.

TABLE III. Highest and Lowest Temperatures, in degrees Fahrenheit, Recorded between 1915 and 1930 at Certain Stations in Southern Arizona.

Station	Yuma	Gila Bend	Ajo	Tucson	Ft. Huachuca	Douglas
Highest	119	121	115	112	105	108
Lowest	28	21	22	15	11	12

In the eastern part of the region, as the altitude increases, summer temperatures are less severe and there is a distinct though mild winter. the eastern mountains but residents of Ramsey Cañon in the Huachuca Mountains told us that in some years there is considerable snowfall during the months of January and February. The rainfall varies considerably at different points across the southern part of the state (Table II.) In general the areas of lowest elevation receive the smallest amount of rain. Precipitation is least in the lower Gila Valley where it is rarely more than three inches annually. It increases gradually toward the east, reaching an average of 11.3 inches at Tucson, 12.27 at Douglas, 14.76 at Fort Huachuca, and probably a somewhat higher figure in the mountains. In most of this area the greater amount falls during the months of July and August while the spring months are the driest. In the vicinity of Yuma, however, there is more rain in the fall and winter than during the remainder of the year.

DESCRIPTIONS OF LOCALITIES STUDIED

The routes traveled in southern Arizona are indicated on the accompanying map (fig. 1). Although frequent brief stops were made for collecting at many points on the various highways, certain regions were especially selected for more intensive work. These localities, in which from four days to nearly three weeks were spent, are indicated by numbered circles and will be described in order.

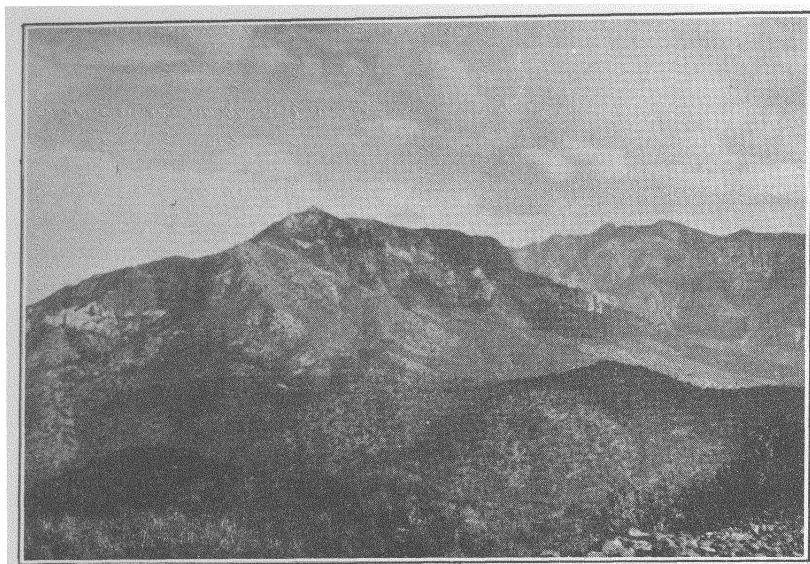


Fig. 2. Huachuca Mountains from the east; Miller Peak at left of center, Carr Peak to the right.

1. HUACHUCA MOUNTAINS, southwestern Cochise County. The Huachuca Mountains rise from a plain with an elevation of slightly more than 4000 feet to a height of 9445 feet on Miller Peak and 9214 feet on Carr Peak (fig. 2). The main axis of the range runs from north-northwest to south-southeast and the southern extremity reaches the Mexican Border near International Monument No. 102 (Mearns, 1907, p. 101). The higher timberline is not reached at any point in the range (fig. 3) but the lower timberline extends down to and out upon the surrounding plain opposite the mouths of some of the cañons. The eastern slopes support considerable vegetation and are deeply incised by a series of more or less parallel cañons, the less precipitous sides of which are in many places heavily wooded with oaks, pines, cedars, and spruces. Agaves of two or three species and occasional sotols and yuccas (fig. 4) are encountered at almost all elevations and, in the lower portions of the cañons, acacias and mesquite form numerous thickets of chaparral. Numerous trails lead to "prospects" or mines most of which have long since been abandoned. In the upper end of Ramsey Cañon at an elevation of slightly less than 7000 feet are the ruins of the old Hamburg Mine of interest to herpetologists as the probable type locality of *Crotalus willardi* Meek, and

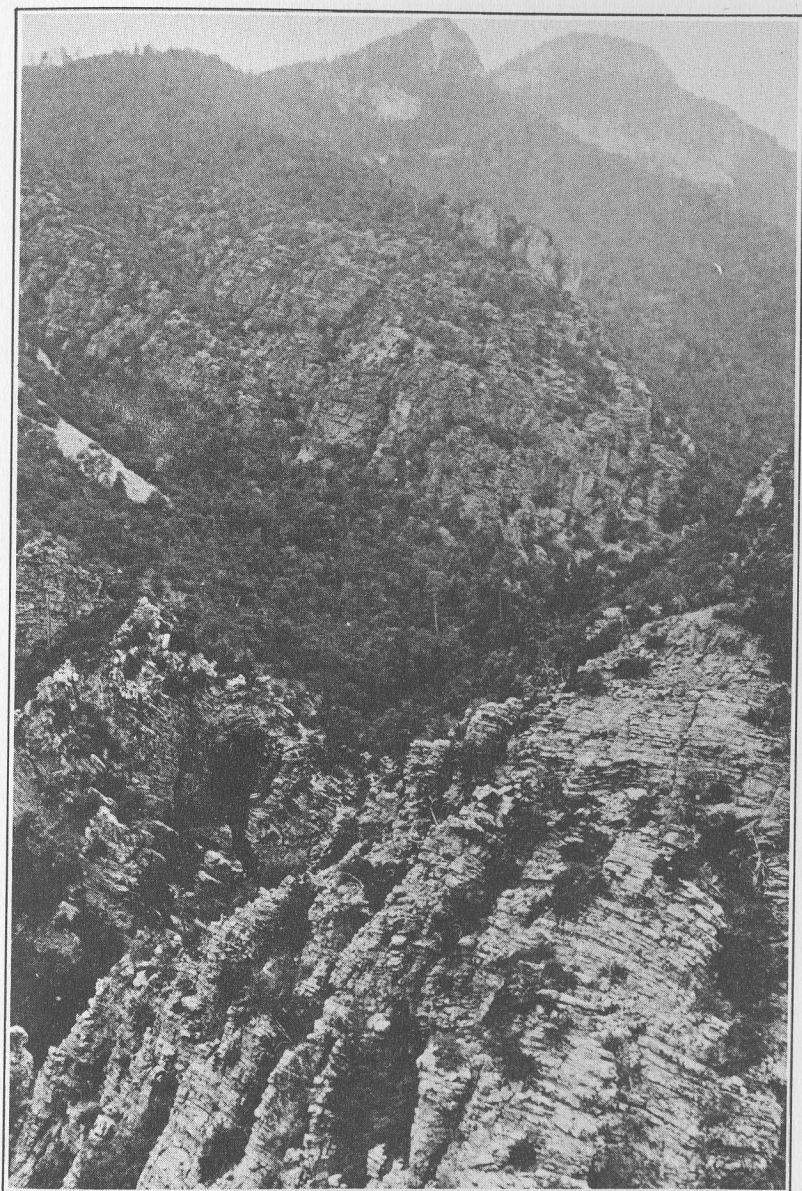


Fig. 3. Ramsey Cañon, Huachuca Mountains. Note rock slide on steep slope at left, a habitat of *Crotalus lepidus klauberi*. *Eumeces callicephalus* was found on side of cliff at lower right.

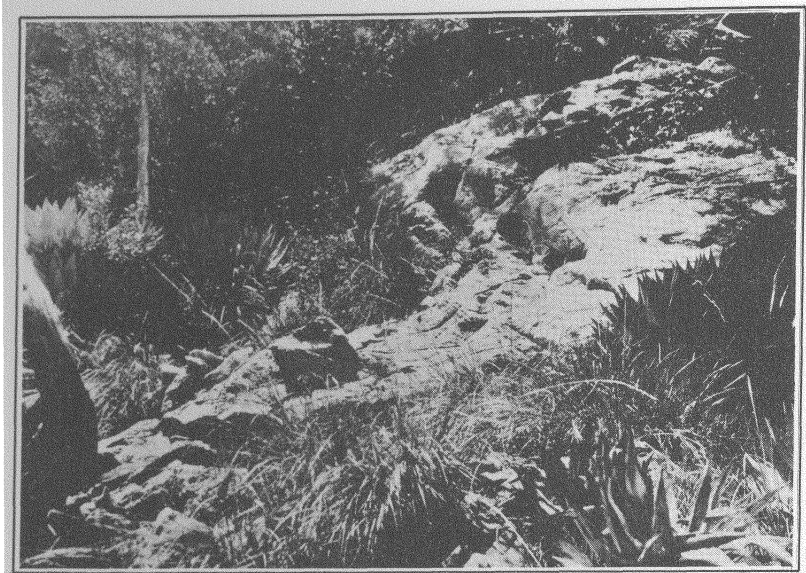


Fig. 4. Habitat of *Sceloporus jarrovi*, *Gerrhonotus kingii* and *Lampropeltis pyromelana* in Ramsey Cañon, Huachuca Mountains.

one of the two places in which this species has been collected north of the Mexican Border.

The lowland vegetation of the San Pedro and Sulphur Springs Valleys consists of desert grassland with scattered shrubs such as mesquite, creosote bush and cat's claw with occasional agaves and yuccas.

Although the Huachuca Mountains have proved to be fertile collecting grounds for many years, conditions affecting the natural fauna of the region are changing. The area is becoming more thickly settled, the adjoining plains are now fenced pastures, several of the cañons contain numerous dwellings with milch cows enclosed on the tiny grassy meadows above, and in Ramsey and Miller Cañons are summer resorts and picnic grounds. In spite of this, much remains of interest to the herpetologist. That the field is not exhausted is indicated by the recent discovery in Ash and Ramsey Cañons of a lizard new to the fauna of the United States (Taylor, 1929).

The time spent by our party in the Huachuca Mountains was from July 18 to August 1, 1930, and from July 4 to 13 and September 2 to 5, 1931. From camps in Carr and Ramsey Cañons we collected at numerous localities and elevations in Ash, Carr, Ramsey, Miller, and Montezuma Cañons as well as on the surrounding plain.

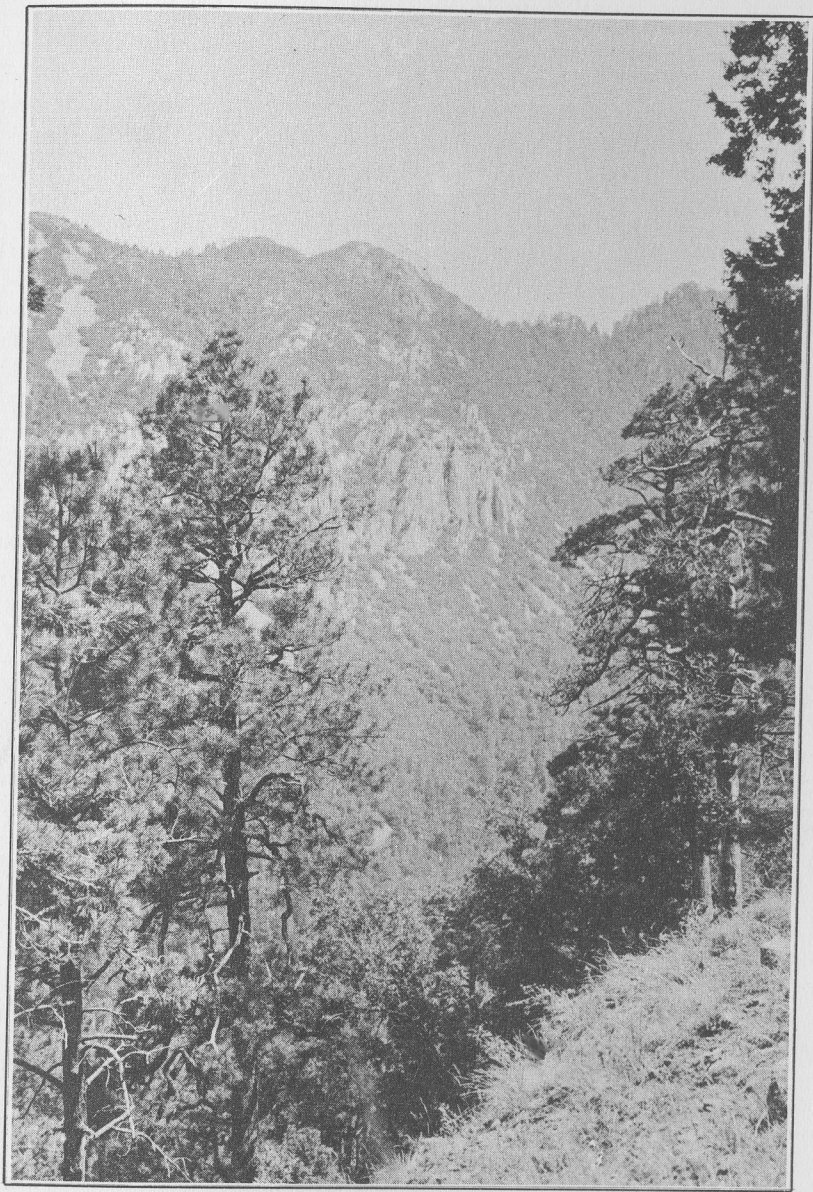


Fig. 5. Morse Cañon, Chiricahua Mountains. Habitat of *Crotalus triseriatus pricei*.
The photograph used as figure 21 was made on the ridge shown above at lower right.

2. **CHIRICAHUA MOUNTAINS**, eastern Cochise County. The Chiricahua range lies mostly north and south and reaches a greater elevation than the Huachuca Mountains. Chiricahua Peak, altitude 9795 feet, is with one exception the highest mountain in southern Arizona. The general topography and the main features of the vegetation are similar to those of the Huachucas. In the region of Turkey Creek and Morse Cañon, the area briefly visited by our party, there was a conspicuous absence of the agaves and sotols which characterize the more southern mountain groups (fig. 5). The Chiricahua region is more sparsely settled and seems to be less completely known scientifically than the Huachucas.

Mrs. Gloyd and I camped on Turkey Creek on the western slope from August 20 to 23, 1931. During this season Mr. Doudna spent some time at the Riggs Home Ranch in the edge of the western foothills, making a few trips to higher elevations.

Southeastern Arizona has received considerable attention from early naturalists and collectors. The Pacific Railroad Reports (Baird and Hallowell, 1859), Baird's report on the reptiles of the Mexican Boundary Survey (1859), Yarrow's section on the reptiles of the Wheeler Survey West of the 100th meridian (1875), and Coues' Synopsis of the Reptiles and Batrachians of Arizona (1875) contain many indefinite records such as "southeastern Arizona" which in the case of such mountain species as *Sceloporus jarrovi*, *Sceloporus scalaris*, *Lampropeltis pyromelana*, and *Crotalus lepidus* doubtless apply to the mountain ranges such as the Huachucas and Chiricahuas. Apparently the first general paper dealing primarily with the Huachuca Mountains and vicinity was that of Van Denburgh (1896) on a collection made by W. W. Price in 1893 and 1894. Then followed Stejneger's paper on the reptiles of the Huachuca Mountains (1902) describing collections made by himself and others. Notes on the flora and fauna of the Huachucas, including a list of reptiles, were included in Mearns' work on the mammals of the Mexican Boundary (1907, p. 101-105). A paper by Stone (1911) included a series of specimens from this mountain range. Mr. J. R. Slevin of the California Academy of Sciences visited this region when collecting in Arizona in 1912 and a report on the specimens secured, and material obtained from other sources, appeared the following year (Van Denburgh and Slevin, 1913). The most complete treatment of the herpetology of the region appears in Van Denburgh's *Reptiles of Western North America* (1922) and Slevin's *Amphibians of Western North America* (1928).

3. **CAÑADA DEL ORO**; western edge of the Santa Catalina Mountains, between Tucson and Oracle, Pima and Pinal Counties.

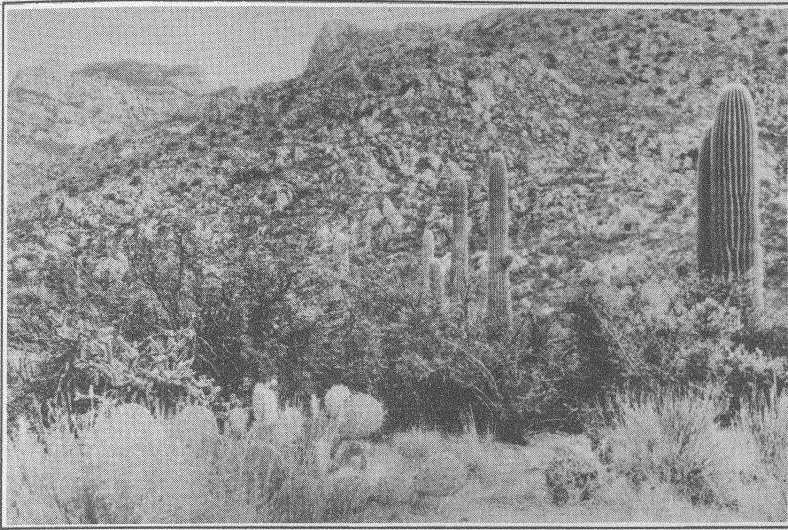


Fig. 6. Sahuaro-ocotillo association in desert on east side of Cañada del Oro, twenty miles north of Tucson. Habitat of *Heloderma suspectum*, *Cnemidophorus*, *sexlineatus perplexus*, *Callisaurus draconoides ventralis*, and *Crotalus tigris*. Foothills of the Santa Catalina Mountains in background.

The Cañada del Oro (literally translated—"Gully of Gold") is a narrow valley probably named by one of the early Spanish explorers who traveled across this region during the 16th century. Through it during the rainy season flows a shallow stream which joins the Santa Cruz River about ten miles northwest of Tucson. The valley floor is dissected by numerous sandy arroyos on the slopes from the Tortillita Mountains on the northwest and the Santa Catalina Mountains on the southeast.

When compared with the desert region to the westward, the Cañada del Oro may be characterized as an area of increased rainfall and an abundance of desert vegetation (fig. 6). The most conspicuous cacti are the giant cactus or sahuaro (*Carnegiea gigantea*), the barrel cactus or bisnaga (*Echinocactus wislizenii*), several species of jointed cactus, prickly pear, and cholla (*Opuntia* sp.), the latter sometimes reaching a height of six feet, and the ball cacti (*Mammillaria*). Among the trees and woody shrubs the most abundant forms are the palo verde (*Parkinsonia*), mesquite (*Prosopis*), ocotillo (*Fouquieria splendens*), the cat's claws or acacias (*Acacia greggii* and others), the crucifixion thorn (*Holocantha emoryi*), and the desert willow (*Chilopsis linearis*). Yuccas, sotols and agaves occur in the cañon mouths and foothills of the Santa Catalina Mountains.

From August 1 to 13, 1930, our camp was located on the east side of the valley, 19 miles north of Tucson, at an elevation of about 3000 feet, and most of the specimens recorded from the Cañada del Oro were collected within a two-mile radius of this location. Reptile life, both with respect to number of species and number of individuals, was strikingly abundant, lizards especially being present in greater numbers than in any other region visited.

Besides the general works on western herpetology already mentioned, other faunal papers dealing with the Tucson region and the Cañada del Oro have been published by Ruthven (1907), Ortenburger and Ortenburger (1926), MacCoy (1932), and King (1932). Mearns (1907, p. 108-111) has given a brief description of the country near Tucson and Old Fort Lowell with comments on the richness of the fauna and a list of the reptiles collected during the work of the International Boundary Commission of 1892-94.

4. WELL NO. 1, an underground pumping station of the Calumet and Arizona Mining Company, 7 miles northeast of Ajo, western Pima County.

As one travels westward from Tucson across the region known as the Papago Country*, there is a gradual drop in the elevation of the desert valleys from slightly above 2400 feet near the Santa Cruz River south of Tucson to about 1500 feet in the "Valley of the Ajo" just east of the Growler Mountains (see map fig. 1). The small, low, isolated mountain groups, composed of a variety of volcanic rocks, are almost destitute of vegetation and are known as the "dead ranges." The flora of the desert is similar in its general nature to that of the Tucson region but scanty in comparison, the individual plants being more or less widely separated by barren rocky areas. The creosote bush (*Covillea tridentata*) characteristic of the western lowlands becomes relatively abundant and may be considered the dominant shrub.

The region in the immediate vicinity of Ajo and Well No. 1 may be described briefly as a creosote bush desert with occasional mesquite shrubs rarely more than five or six feet in height, a few palo verdes and acacias, with the cacti represented principally by scattered chollas and sahuaros (figs. 7 and 8). The soil is mostly hard and rocky, areas near mountains being strewn with lava talus; accumulations of wind-blown sand are infrequent.

At the time of our visit no rain had fallen for many weeks, the sky was practically cloudless, and the temperature reached 108°F. daily. From August 14 to 17 inclusive, 1930, we collected in the

* For a detailed discussion of the geology, physiography and climate of this region see Bryan (1925).

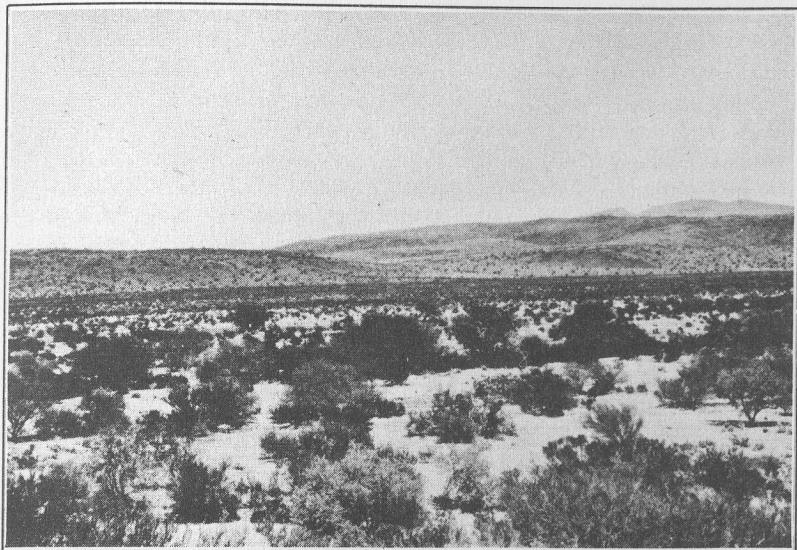


Fig. 7. Desert plain near Ajo. Mesquite and creosote bush are the dominant forms of vegetation. Habitat of *Cnemidophorus tessellatus*, *Dipsosaurus dorsalis* and *Crotalus cerastes*.

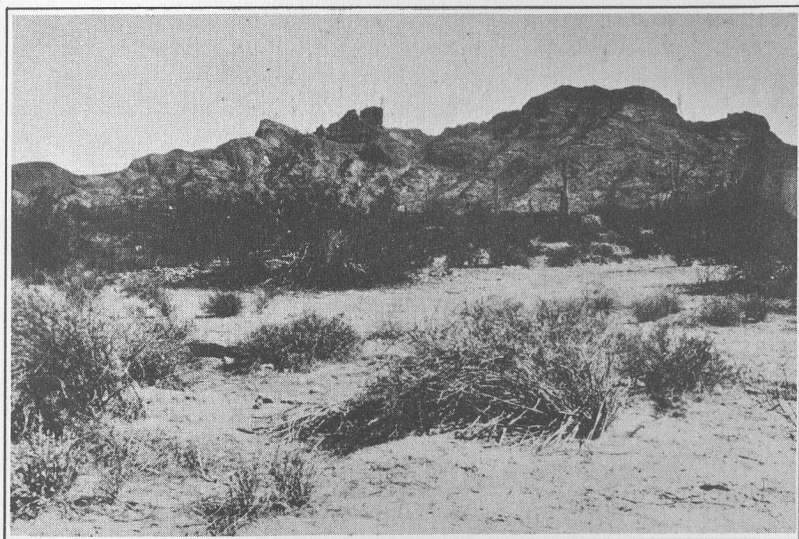


Fig. 8. The Papago Country near Bates Well, a creosote bush desert with scattered growths of mesquite and sahuaro. The Growler Mountains, one of the "dead ranges", in background.

vicinity of Well No. 1 and Ajo and made a one-day trip south and west through Growler Pass to Bates Well and into Growler Valley (see map, fig. 1). It was our intention to follow this route westward, joining the old Spanish trail, "El Camino del Diablo", near Papago Well and continuing to Yuma by way of Tule Tank and Tinajas Altas. Upon learning of the almost impassible condition of the road, however, this plan was abandoned.

Practically no previous herpetological work has been done in this area. Dr. Mearns and his assistants gave some attention to the amphibians and reptiles during the marking of the International Boundary in 1894 (Mearns, 1907) listing a few species collected at that time.

5. GILA VALLEY, six miles east of Yuma, Yuma County.

With its low elevation of under 150 feet, its extreme dryness and high temperatures (see Tables I - III), and its dearth of the larger types of vegetation, this region represents American desert conditions exceeded in severity perhaps only in the Salton Sea area and Death Valley, California. The south side of the Gila Valley for some miles east of Yuma is a series of low ridges of soft sand more or less parallel with the river. The vegetation consists of a sparse growth of creosote bush and bur-sage (*Franseria*) with infrequent mesquite trees (fig. 9).

The location of our Gila Valley camp from August 18 to 22, 1930, was between five and six miles east of Yuma and about a mile south of the river. The high temperatures restricted our collecting activities to early morning, late afternoon and after nightfall.

Because of its accessibility and its special points of interest this area has attracted the attention of collectors and its fauna is well represented in western museums. The general herpetological works of Van Denburgh (1922) and Slevin (1928) have summarized the records of reptiles and amphibians of this region up to their respective dates of publication.

6. TINAJAS ALTAS, twenty-eight miles south of Wellton, southern Yuma County.

Tinajas Altas, or "high tanks", is the name of a watering place on the eastern side of a small range of granite mountains bearing the same name but in reality a southern prolongation of the Gila Range. A series of eight rock tanks, distributed for 500 feet along a stream course so steep that it may be considered an almost continuous series of falls, is filled during the rainy season by surface drainage from a small upland valley with relatively gentle slopes.* Water of a sort

* See Bryan, 1925, p. 132-134, pl. 18, for a complete description of the geological and physiographical features of these tanks and their environs.

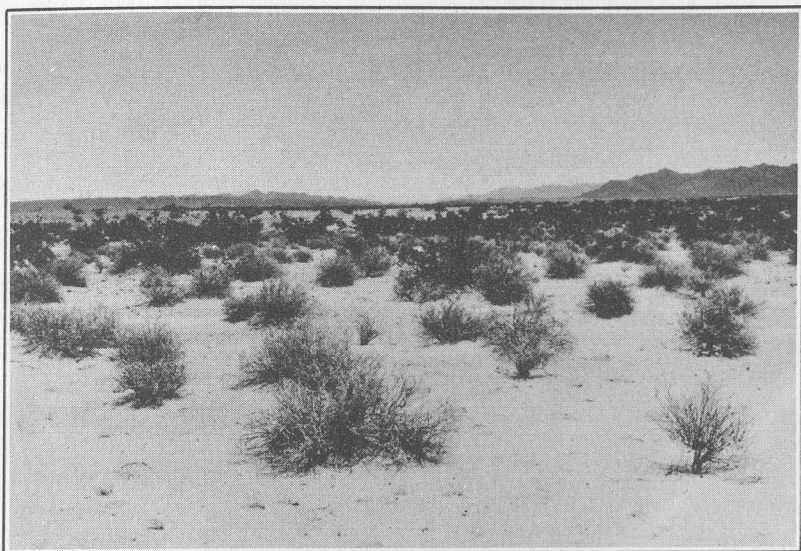


Fig. 9. Desert of the Gila Valley east of Yuma. Soft sand habitat of *Callisaurus draconoides ventralis*, *Sonora occipitalis* and *Crotalus cerastes*.

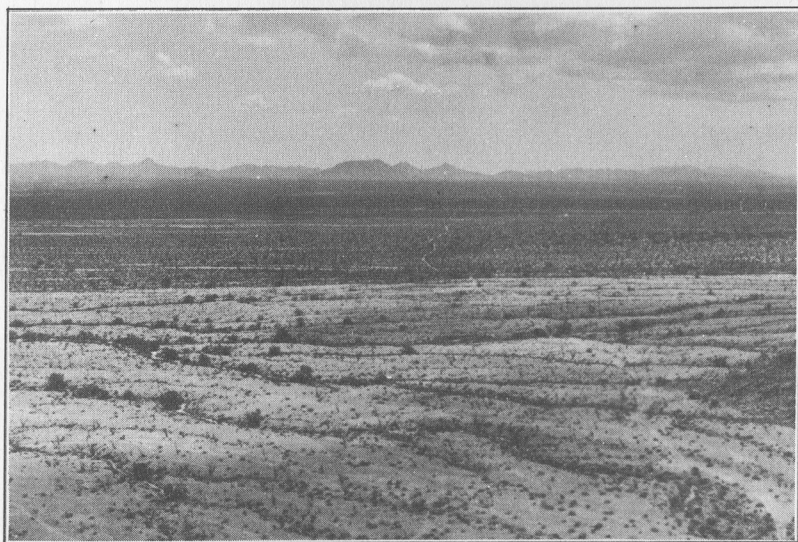


Fig. 10. Lechuguilla desert looking southeast from Tinajas Altas, the Cabeza Prieta Mountains in the distance. The road is "El Camino del Diablo."

is available here during most of the year. The lowest tank is accessible to horses and has been in use for many years by travelers of the famous "Camino del Diablo", one of the main routes from Mexico to California during the Gold Rush of the fifties.

Climatic conditions in this locality are similar to those of the Yuma region but the soil and vegetation differ. The mountain slopes are barren and strewn with talus and the soil of the adjoining valley, the Lechuguilla Desert, is hard and rocky with little or no loose sand except in the beds of arroyos (fig. 10). The vegetation is sparse, the dominant shrub creosote bush. Occasional ocotillo, palo verde, palo fierro or ironwood (*Olneya*), acacias and mesquite trees occur, and among the cacti the jointed forms or chollas are most common although scattered bisnagas and sahuaros are present.

With the exception of the few specimens collected by Mearns during the marking of the Boundary in 1894 (Mearns, 1907, p. 122-124), no previous herpetological collecting seems to have been done in this part of the Papago Country. Records based on some of the Mearns material in the National Museum have been published by Van Denburgh and others.

The period spent at Tinajas Altas by Mrs. Gloyd and myself was from August 25 to 30, 1931.

DISCUSSION OF FAUNAL AREAS

Practically all of Arizona south of the Gila and Salt Rivers lies within the Austral Region and most of it within the Lower Austral or Lower Sonoran Life Zone. The Upper Sonoran is represented only in the foothills, cañons, and slopes of the larger mountain groups in the southeastern portion. Only a few of the mountain ranges considered in this paper (viz., the Santa Catalina, Santa Rita, Huachuca, and Chiricahua) have sufficient elevation to exhibit characteristics of the Transition Zone. Therefore, a discussion of the details of animal distribution in this area must deal very largely, if not exclusively, with the Lower Sonoran Zone.

The term "faunal area", as indicated by Grinnell (1914, p. 64; 1915, p. 9-12), is applied to a natural subdivision of a life zone which maintains enough uniformity in temperature, rainfall, and other environmental factors to support a characteristic and distinctive group of animal and plant species. That this is a useful concept to students of animal distribution, I think no one will dispute, although, as clearly stated by Grinnell, insufficient data are available to permit statistical analysis of the various aspects of this problem. In this brief

report it is not possible to review even the most important contributions to this phase of zoogeography. Certain papers dealing wholly or in part with southern Arizona, however, can profitably be considered since they form the basis for the application of my own observations.

In his *Mammals of the Mexican Boundary of the United States*, (1907), which contains a wealth of data useful to the student of the southwestern vertebrate fauna, and which appears to have been somewhat overlooked by herpetologists, Dr. Mearns described and mapped (p. 73-74, pl. 2) a number of "differentiation tracts" based upon his study of variation in mammals collected along the International Boundary from the Gulf of Mexico to the Pacific Ocean. While these tracts are not discussed at length, it seems that this author had in mind a concept similar to that of more recent workers who have used the term "faunal area". Two of Mearns' differentiation tracts include the southern Arizona region. His "elevated central tract" extends from the eastern border of the state to the "Sonoyta River Valley, west of the Cabota and Nariz Mountains", or, in terms of landmarks north of the border, the Ajo and Pozo Redondo Mountains. His "western desert tract" includes the territory from the Sonoita Valley "to the east base of the Coast Range", or roughly the Colorado Desert of Arizona and California. Swarth (1929), as the result of studies on the distribution of birds and mammals, described two faunal areas in southern Arizona: an "eastern plains area" in the southeastern corner of the state, bounded on the west by the Santa Rita Mountains, and a "western desert area" extending from the Santa Rita Range to the Colorado River.

It will be seen that both these writers recognized certain faunal differences indicated by characteristically different species in the eastern and western parts of this region. The central section, with its unusually rich fauna and flora, seems not to have received its full measure of consideration, the one author combining it with the higher plains of the east, the other including it with the lower desert of the west.*

From a consideration of the distribution of reptiles as indicated by my own collections and observations, additional museum material examined, and a study of herpetological literature, I consider it desirable

* As this manuscript goes to press there has come to hand a paper by A. J. van Rossem (Notes on birds in relation to the faunal areas of south central Arizona. Trans. San Diego Soc. Nat. Hist., vol. 8, pp. 121-148, pls. 17-18, 3 maps) which discusses faunal areas in southern Arizona. Mr. van Rossem concludes "that southeastern Arizona [west to the Baboquivari Mountains] is, on the basis of its Lower Sonoran, Upper Sonoran, and Boreal Zone birds, the northwestern portion of a large and well characterized area of differentiation which has as its geographical hub the mountain mass of the northern Sierra Madre which lies north of the east-west course of the Yaqui River." Although this advocates a more western boundary, the Baboquivari Mountains, for the Eastern Plains Area, it is not inconsistent with my conclusions.

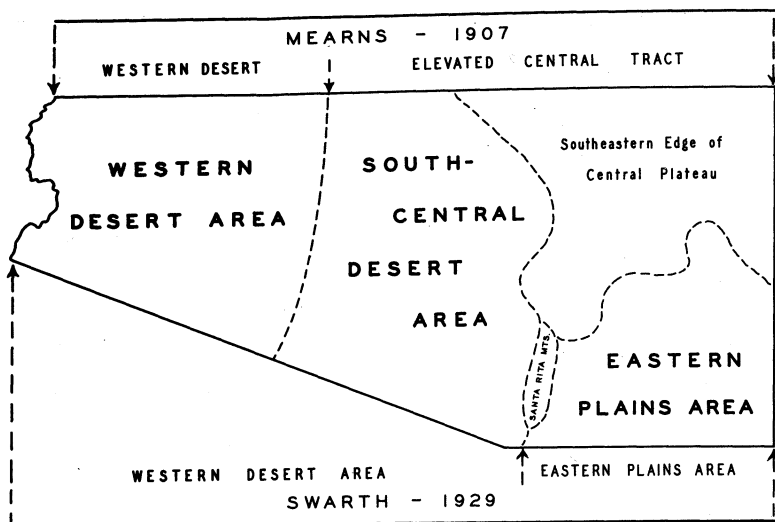


Fig. 11. Diagram showing the relationship of the Faunal Areas proposed in this paper to those of Mearns (1907) and Swarth (1929).

to recognize three faunal areas in the lowlands (Lower Sonoran) of southern Arizona: (1) an Eastern Plains Area as delimited by Swarth (*loc. cit.*), (2) a Western Desert Area with approximately the same eastern boundary as that suggested by Mearns, and (3) a South Central Desert Area occupying the intervening region, approximately from the vicinity of Ajo and Gunsight on the west to the Santa Rita Mountains in the east, extending northward to the lower edge of the highlands north of Phoenix and southward indefinitely into Sonora along the western border of the Mexican Plateau. Reference to figures 1 and 11 will make clear the relationships of these three classifications. The higher elevations of the eastern mountains (Upper Sonoran and Transition Zones) are, of course, excluded from these three categories since their reptile fauna differs conspicuously from that of the surrounding deserts and plains, and from that of the relatively barren western mountains.

That each of these areas differs from the others in elevation and in such climatic features as temperature and rainfall is indicated in tables I and III. Of the three, the Eastern Plains Area, which roughly coincides with the boundaries of Cochise County, is the most distinct.

The vegetation is of the plains type and the fauna also appears to be definitely related to that of the Great Plains. As Swarth has pointed out (*loc. cit.*, p. 270), the Santa Rita Mountains form a tangible natural boundary on the west.

The dividing line between the Western Desert Area and the South Central Desert Area is not so obvious. Swarth (*loc. cit.*, p. 277) with reference to the Mearns classification says, "I can not appreciate any reason for the dividing line he draws across the desert midway between Tucson and Yuma, with the 'Western Desert Tract' to the westward, the 'Elevated Central Tract' to the eastward. Neither is there any general division of forms in mammals, birds or plants along that line, nor is there any marked change in altitude or climate." His figure G, p. 277, however, indicates that *Lepus alleni alleni*, the Antelope Jack Rabbit, a member of a group principally Mexican in distribution, is confined to a region in south central Arizona which corresponds rather nicely to this South Central Desert Area. He further states (p. 365) that the dividing line between the forms *eremicus* and *deserticola*, subspecies of *Lepus californicus* which occurs uninterruptedly across southern Arizona, lies somewhere near the western limit of the range of *Lepus alleni*. This also corresponds with the approximate western boundary of the South Central Desert Area.

Arizona jack rabbits have been studied more recently by Vorhies and Taylor (1933). In a discussion of the range of *Lepus alleni*, these authors state (p. 480) that they "are unable to determine the factors limiting the distribution of the Antelope Jack Rabbit . . . There are no appreciable physical or climatic barriers *except to the westward* [*italics mine*]. In the vicinity of Gunsight, Pima County [the approximate western limit of the South Central Desert Area], the soil and vegetation change somewhat, the soil becoming softer and more sandy."

I have not gone deeply into a study of the distribution of Arizona birds and mammals, but a careful consideration of the distribution of reptiles in this region, in my opinion, amply justifies the recognition of some set of environmental factors, as yet not understood, which limit the spread of certain species at approximately this point.

The distribution of southern Arizona reptiles, determined as accurately as my present facilities permit, is summarized in table IV. The list given here does not include all species that have been recorded from the region. Most of those that could be added are either so rare or little known that they would not materially help the problem in hand. For this reason it is thought best to limit the number to the species personally studied. Since the amphibians of this region are for the most part wide-ranging species the distribution of which is

TABLE IV.
Distribution of Southern Arizona Reptiles by Faunal Areas

SPECIES	Western Desert Area	South-Central Desert Area	Eastern Mountains	Eastern Plains Area
<i>Coleonyx variegatus</i>	*****	*****		* *
<i>Dipsosaurus dorsalis dorsalis</i>	*****			
<i>Crotaphytus collaris baileyi</i>	*****	*****		*****
<i>Crotaphytus wislizenii</i>	*****	* * *		
<i>Sauromalus obesus</i>	*****	* * *		
<i>Callisaurus draconoides ventralis</i>	*****	*****		* * * *
<i>Holbrookia elegans</i>		*****		
<i>Holbrookia maculata approximans</i>		* * *		*****
<i>Holbrookia pulchra</i>			*****	
<i>Holbrookia texana</i>		* * *		*****
<i>Uta graciosa</i>	*****			
<i>Uta ornata symmetrica</i>	*****	*****	*	* * *****
<i>Uta stansburiana stejnegeri</i>	*****	*****		*****
<i>Sceloporus clarkii clarkii</i>			*	*****
<i>Sceloporus jarrovi jarrovi</i>			*****	
<i>Sceloporus magister magister</i>	*****	*****		
<i>Sceloporus scalaris</i>			*****	
<i>Sceloporus undulatus consobrinus</i>			*	*****
<i>Phrynosoma cornutum</i>				*****
<i>Phrynosoma douglassii hernandesi</i>			*****	*
<i>Phrynosoma modestum</i>				*****
<i>Phrynosoma platyrhinos</i>	*****			
<i>Phrynosoma solare</i>	* * * *	*****		* * *
<i>Gerrhonotus kingii</i>			*****	
<i>Heloderma suspectum</i>	* * * *	*****		* * *
<i>Cnemidophorus sexlineatus perplexis</i>		*****		*****
<i>Cnemidophorus tessellatus tessellatus</i>	*****	*****		* * * *

TABLE IV.
Distribution of Southern Arizona Reptiles by Faunal Areas

SPECIES	Western Desert Area	South-Central Desert Area	Eastern Mountains	Eastern Plains Area
<i>Eumeces callicephalus</i>			*****	
<i>Eumeces absoletus</i>			*	*****
<i>Heterodon nasicus</i>				*****
<i>Masticophis semilineatus</i>		*****	*	*****
<i>Masticophis flagellum frenatus</i>	*****	*****		*****
<i>Masticophis piceus</i>		*****		
<i>Salvadora hexalepis</i>	*****	*****		*****
<i>Pituophis sayi affinis</i>	*****	*****	*	*****
<i>Lampropeltis getulus splendida</i>		*****		*****
<i>Lampropeltis getulus yumensis</i>	*****	*****		*****
<i>Lampropeltis pyromelana</i>			*****	
<i>Sonora occipitalis</i>	*****			
<i>Thamnophis eques</i>		*****		*****
<i>Thamnophis megalops</i>	*	*****		**
<i>Thamnophis marcianus</i>	*****	*****		*****
<i>Trimorphodon lyrophanes</i>	*	*****	*	* * *
<i>Micruroides euryxanthus</i>	*	*****		**
<i>Crotalus cinereous</i>	*****	*****		*****
<i>Crotalus cerastes</i>	*****	* * *		
<i>Crotalus lepidus klauberi</i>			*****	
<i>Crotalus molossus molossus</i>			* *****	**
<i>Crotalus scutulatus</i>	*****	*****		*****
<i>Crotalus tigris</i>		*****		
<i>Crotalus triseriatus pricei</i>			*****	
<i>Gopherus agassizi</i>	*****	*****		
<i>Terrapene ornata</i>		*		*****

chiefly determined by the presence of water, their occurrence is not considered of significance in this connection. An exception to this statement is *Bufo alvarius* which rarely occurs east of the desert areas.

Excluding the typical mountain species, and also the plastic low-land forms known to range entirely across the state, the remaining may be divided into five groups:

I. SPECIES ENTIRELY OR CHIEFLY RESTRICTED TO THE EASTERN PLAINS AREA AND THE FOOTHILLS OF THE EASTERN MOUNTAINS:

<i>Sceloporus clarki</i>	<i>Eumeces obsoletus</i>
<i>Sceloporus undulatus consobrinus</i>	<i>Heterodon nasicus</i>
<i>Phrynosoma cornutum</i>	<i>Terrapene ornata</i>
<i>Phrynosoma modestum</i>	

II. SPECIES CHARACTERISTIC OF THE EASTERN PLAINS AREA BUT OCCURRING ALSO IN THE SOUTH CENTRAL DESERT AREA:

<i>Holbrookia maculata approximans</i>	<i>Lampropeltis getulus splendida</i>
<i>Holbrookia texana</i>	<i>Thamnophis eques</i>
<i>Cnemidophorus sexlineatus perplexus</i>	

III. SPECIES ENTIRELY OR CHIEFLY RESTRICTED TO THE WESTERN DESERT AREA:

<i>Dipsosaurus dorsalis dorsalis</i>	<i>Phrynosoma platyrhinos</i>
<i>Uta graciosa</i>	<i>Sonora occipitalis</i>

IV. CHARACTERISTICALLY DESERT SPECIES OCCUPYING THE WESTERN AND SOUTH CENTRAL DESERT AREAS, SOME OCCASIONALLY INTRUDING INTO THE EASTERN PLAINS AREA:

<i>Coleonyx variegatus</i>	<i>Heloderma suspectum</i>
<i>Crotaphytus wislizenii</i>	<i>Lampropeltis getulus yumensis</i>
<i>Sauromalus obesus</i>	<i>Trimorphodon lyrophanes</i>
<i>Callisaurus draconoides ventralis</i>	<i>Micruroides euryxanthus</i>
<i>Sceloporus magister</i>	<i>Crotalus cerastes</i>
<i>Phrynosoma solare</i>	<i>Gopherus agassizii</i>

V. SPECIES APPARENTLY RESTRICTED TO THE SOUTH CENTRAL DESERT AREA, OR IMMEDIATELY ADJACENT TERRITORY:

<i>Holbrookia elegans</i>	<i>Masticophis piceus</i>
<i>Cnemidophorus sexlineatus perplexus</i> (giant form, see p. 101, 115).	<i>Thamnophis megalops</i>
	<i>Crotalus tigris</i>

It will be noted that the species of Group I are practically all characteristic of the Great Plains Province with major portions of their ranges east of Arizona. The Arizona populations of these species, therefore, represent a peripheral plains fauna to which the deserts

present a definite barrier to westward spreading. Group II is composed of more plastic forms, apparently also immigrants from the Plains, or at least with the centers of their ranges to the eastward, which are apparently able to endure greater aridity than those of Group I, but which seem unadaptable to the extreme desert conditions of the Colorado Valley. In marked contrast to these are the species comprising Group III, all highly adapted to desert conditions and restricted to the more soft and sandy soil of the Western Desert Area. The range centers of these forms all lie to the westward, the Arizona populations thus being peripheral to a fauna spreading into this area from the west. The species of Group IV, ranging across both Western and South Central Desert Areas, are less restricted in distribution than those of the preceding. Most of them are also apparently of western origin but some (*Phrynosoma solare*, *Heloderma suspectum*, *Trimorphodon lyrophanes*, and *Micruroides euryxanthus*) appear to be most characteristic of the South Central Area, spreading out of it both to the eastward and westward, and probably are derived from southern stock. Group V includes the forms indigenous to the South Central Desert Area. Three of these, *Holbrookia elegans*, *Thamnophis megaloops* and *Crotalus tigris*, seem clearly to be of southern origin since their ranges are far more extensive in Mexico than in the United States. *Masticophis piceus* is known only from this area in south central Arizona and from Lower California (Ortenburger, 1928, p. 130). Its apparent absence from the deserts of the Colorado Valley is a range discontinuity similar to that of *Crotalus viridis oreganus* (Klauber, 1930, p. 130, 135) and *Trimorphodon lyrophanes* (Klauber, 1928, p. 191, pl. 22). Whether or not the two populations of *Masticophis piceus* and of *Crotalus v. oreganus* thus separated by the Colorado Desert are in each case conspecific, this strip of austere territory now seems to prevent their intermingling.

That *Cnemidophorus sexlineatus perplexus* reaches an extremely large relative size in the South Central Desert Area, as noted by Ruthven (1907, p. 557) and Van Denburgh and Slevin (1913, p. 408) in the Tucson region, has a special interest in connection with this problem. In a more recent study, Burt (1931, p. 129) concluded that these giant lizards represent an end form in the evolution of color pattern. Such a phenomenon may readily be accompanied by a tendency toward giantism and is all the more probable at the periphery of the range, as is the case here (Burt, *loc. cit.*, fig. 23). At the very least, it is suggested that the south central part of Arizona offers a very favorable environment for this species.

The South Central Desert Area, then, appears to be a meeting

place for a varied assemblage of faunal elements: the westernmost branches of numerous eastern species, the eastern outposts of a group of species probably of western origin, an intrusion of southern forms from the edge of the Mexican Plateau, and along with all these, a considerable number of more plastic Lower Sonoran species which range continuously across the entire area. From these considerations, the extreme richness of the herpetological fauna of south central Arizona can be appreciated.

In concluding this discussion, I wish to comment briefly upon a paper by the late J. Eugene Law (1929) published as a critique of Mr. Swarth's study (1929) to which I have made frequent reference. Mr. Law apparently took a less optimistic view of the problem of subzonal environmental factors and seriously questioned the desirability of defining faunal areas in general terms, citing numerous instances in which he considered Swarth's indicator species invalid because of their occurrence to the one side or the other of the approximate limits of the areas defined.

It is certainly not my intention, and neither, I think, was it Mr. Swarth's, to convey an idea of inflexible limiting lines in describing these areas. Mr. Law pointed out that each species responds in its own way to the several associational factors present, and with this I readily agree. When we find, however, a group of species responding to certain environmental factors in a manner sufficiently similar to restrict them to a limited area, we may assume the existence of a barrier, tangible or otherwise. Only such barriers as affect an appreciable number of species can, of course, profitably be used in delimiting faunal areas. Naturally, one could increase the number of such areas to the total number of species in a given region if all the idiosyncracies of habitat requirements and complete range of each could be known. There would be no gain in this. The faunal area concept must necessarily be at least as arbitrary as that of the Life Zones. Both serve a useful purpose in giving a certain unity to observed facts until, through increase in knowledge of animal responses to topographical, meteorological, and biological factors of environment, such facts can be interpreted with greater assurance of accuracy than is now possible.

ANNOTATED LIST OF SPECIES

AMPHIBIANS

Scaphiopus couchii Baird. Sonoran Spadefoot.

A single individual of this spadefoot was dug up July 31, 1930, from a mass of old adobe bricks in an abandoned cistern six miles south of Charleston, a railway station about half way between Fort Huachuca and Tombstone, Cochise County. Two others occurred in a series of toads collected about 9:00 P. M., July 13, 1931, at Willcox.

Scaphiopus hammondi Baird. Western Spadefoot.

Many of these toads were singing in newly-formed rain pools on a salt-grass flat just at the edge of Willcox, Cochise County, July 13, 1931. They were rather widely separated and somewhat shy for they ceased calling when approached, but in most cases retained their positions. Numerous small individuals were found on dry ground between the pools and on a nearby highway.

Bufo alvarius Girard. Giant Toad. (fig. 12).

Giant toads were collected in Pima County during August, 1930. The species was seen only in late evening or at night, and all except

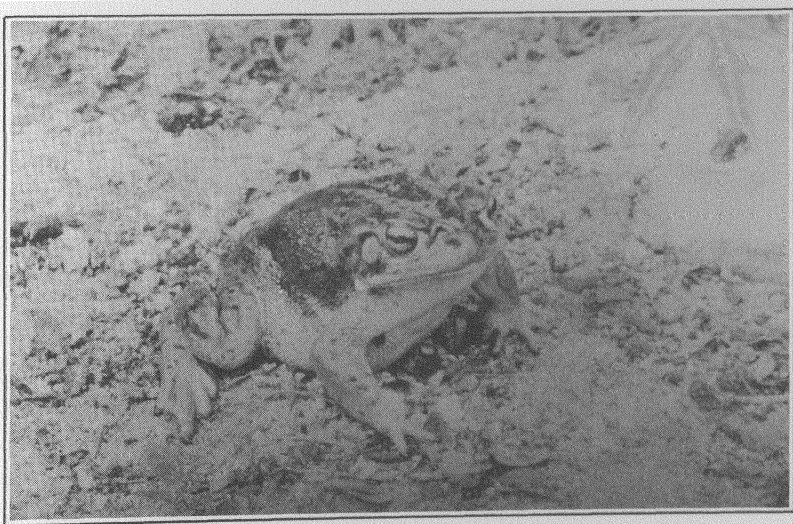


Fig. 12. The Giant Toad, *Bufo alvarius*. Cañada del Oro, twenty miles north of Tucson.

one were taken just before or during a thunderstorm. One wandered into camp the night of August 5; three were in a sandy road near the Santa Cruz River on August 6, and three were found among clumps of grass on August 7. All of these localities are in the Cañada del Oro, twenty miles north of Tucson. A single specimen was taken at Well No. 1, six miles northeast of Ajo on August 14.

Bufo cognatus cognatus Say. Great Plains Toad.

Three specimens were taken in a sandy road at night August 6, 1930, near the Santa Cruz River, sixteen miles north of Tucson, and two were obtained at Willcox, July 13, 1931.

Bufo punctatus Baird and Girard. Red-spotted Toad.

In the Huachuca Mountains a toad of this species was taken July 19, 1930, in the dry creek bed of Carr Cañon at an elevation of about 5300 feet. Another was found July 20 at an elevation of 7600 feet on the north side of Carr Peak. The latter was beneath a stone near Carr Cañon Creek. Three were obtained August 4 near a creek on the west side of the Santa Catalina Mountains, twenty miles north of Tucson. In 1931 this species was collected only at Tinajas Altas, Yuma County, August 25 and 27. It was found in considerable numbers in and around the edge of the lowest rock tank.

Bufo woodhousii Girard. Rocky Mountain Toad.

Specimens of this toad were taken at night in the lower end of Carr Cañon, Huachuca Mountains, on July 20 and 24, 1930. Two others were found in early afternoon beneath a pile of boards near a shed in Sulphur Springs Valley, ten miles southeast of Willcox, July 19, 1931.

Hyla arenicolor Cope. Sonoran Tree Frog.

We first met this species in the Cañada del Oro, August 2, 1930, when two were found about noon on the shady side of small boulders in the creek. The temperature indicated by a thermometer suspended beneath a mesquite tree was 106° F. That evening about 9:00 o'clock several of these frogs sang at various points along the watercourse until our searching disturbed them. Those observed were on the bank at the edge of the water or on boulders in the creek. Two days later more were found on rocks along another creek near the Catalina Mountains on the east side of Cañada del Oro.

On August 6, a series of seventeen was obtained in Cañada del Oro between 7:00 A. M. and noon. Although they often occurred in very dry situations, none were at any great distance from the water.

A space protected from the sun between two large boulders contained six. Heavy local showers during the preceding forty-eight hours had caused a marked rise in the stream level and may have brought the frogs out of more secure hiding places.

In the Huachuca Mountains, July 10, 1931, the day following the first heavy rain of the season, two tree frogs were found in a dry crevice on a high cliff nearly 300 feet above Ramsey Cañon Creek. Two days later three were collected on large boulders in the stream at the bottom of the cañon. Later in the season, September 3, one was found on a wet rock wall in Ramsey Cañon. Another was obtained in the Chiricahua Mountains at an elevation of 6500 feet on Turkey Creek, August 20.

Rana pipiens Schreber. Leopard Frog.

Leopard frogs were taken August 4 and 8, 1930, in a creek between the Cañada del Oro and the Catalina Mountains, twenty miles north of Tucson, and on the night of July 13, 1931, in rain pools of a salt-grass flat at Willcox.

LIZARDS

Coleonyx variegatus (Baird). Banded Gecko.

A specimen of this little gecko taken near Tucson was presented to us by Dr. C. L. Vorhies of the University of Arizona.

Dipso-saurus dorsalis dorsalis (Baird and Girard). Crested Lizard.

These large lizards, found among the sparse growths of creosote bush, mesquite, and cholla, represented the most conspicuous species of western Pima and southern Yuma Counties. When alarmed they took refuge in mammal burrows which seemed always at hand in the sides of the mounds formed where the vegetation anchors the surface soil. Most published accounts of this species associate it with a loose sand habitat. Such areas are not abundant in the vicinity of Ajo where the soil, although sandy, is rather hard packed, and yet we found these lizards very numerous. In the Lechuguilla Desert near Tinajas Altas when the temperature in the shade of the mountain was 108°F. toward midafternoon, they were the only reptiles that were under no cover, except for the scant shade of the creosote bushes under which they crouched.

Compared with other species of the same region, these lizards were very shy and alert to approaching danger. On foot it was almost impossible to approach them within the effective range of a 10-inch .22

caliber collecting pistol, although they could often be shot from the car. A 9 mm. shotgun with a special load of dust shot was effective up to about twenty yards. The best success in collecting this species, however, was by the use of a smooth-bore .22 caliber repeating rifle with a 22-inch barrel. This had the advantage of greater economy and was effective at a greater distance than the 9 mm. shotgun. For collecting in open country where some of the lizards are extremely wary, such an arm was found to be an ideal supplement to the usual 10-inch smooth-bore pistol.

Fifty-two specimens of *Dipso-saurus* were collected during the month of August, 1930 and 1931, in the following localities: PIMA COUNTY: ten miles east of Ajo; Well No. 1, six miles northeast of Ajo; five miles southwest of Ajo; Bates Well, twenty-one miles southwest of Ajo; five miles north of Ajo. YUMA COUNTY: Lechuguilla Desert, east of Gila Mountains between Wellton and Tinajas Altas; near Coyote Water, six miles east of Tinajas Altas. MOHAVE COUNTY: one mile north of Topock.

Crotaphytus collaris baileyi (Stejneger). Western Collared Lizard.

A collared lizard received from Mr. Sanders was taken in Maricopa County at Cañon Lake on the Salt River, seven miles north of Superstition Mountain.

Crotaphytus wislizenii Baird and Girard. Leopard Lizard.

The leopard lizard occurred in the same lowland desert country as *Dipso-saurus d. dorsalis* but much less abundantly. It was also shy and very difficult to approach. Individuals were seldom seen more than a foot or two from the entrance of a burrow into which they usually would dash before one could approach within pistol range. Most of those secured were shot from the car.

One specimen was taken at Well No. 1, six miles northeast of Ajo, Pima County, August 14, 1930. Six were collected August 28 and 30, 1931, in the Lechuguilla Desert between Tinajas Altas and Wellton, Yuma County.

Sauromalus obesus (Baird). Chuck-walla.

One collected at Tinajas Altas, Yuma County, is a juvenile individual showing fairly distinct bands on the tail. Mr. Sanders has sent specimens from Cottonwood Creek, twenty miles northeast of Mesa; from Superstition Mountain, Pinal County, twenty-seven miles east of Mesa; and from the Salt River Valley, seven miles north of Superstition Mountain, Maricopa County. For this species these are the easternmost records that I have been able to obtain.

Callisaurus draconoides ventralis (Hallowell). Desert Gridiron-tailed Lizard.

This species was most frequently met in sandy arroyos bordered with mesquite. It was active from early morning until about 10:00 A. M. and again from late afternoon until dark. Some were taken during the hottest part of the day, however, and at 10:00 P. M. on a cloudy night, August 28, 1931, the lights of the automobile revealed two in a sandy arroyo near Tinajas Altas. While most frequently seen in open sandy areas, it was often observed resting upon boulders or running with great speed between clumps of vegetation. One was seen in the top of a dead cholla.

When quiet and viewed from the rear this lizard is practically indistinguishable against the sand, but when perched upon a boulder, raising and lowering its body by means of its forelegs and waving its tail over its back, it is very conspicuous; the blue and black side markings of the males, and the contrasting black and white ventral tail pattern, are displayed effectively. Although I watched this performance several times I saw no spreading of the throat fan. This addition to such display behavior may be restricted to the time of prenuptial activities earlier in the season. Young individuals almost invariably waved their tails in the air when startled. These revealing movements seemed to be an alarm reaction rather than a display performance.

Localities: PRIMA COUNTY: Cañada del Oro, twenty miles north of Tucson; desert eighteen miles west of Tucson; Well No. 1, six miles northeast of Ajo; Growler Pass, between Ajo and Bates Well. PINAL COUNTY: In highway, thirty miles north of Tucson. YUMA COUNTY: Lechuguilla Desert between Wellton and Tinajas Altas; near International Boundary, five miles south of Tinajas Altas; five miles east of Yuma.

Linsdale (1932, p. 359) has pointed out some of the problems in the taxonomy of this group. The genus is still in need of thorough study, however, and until a better understanding of the forms *gabbii* and *ventralis* is reached the latter name may be applied to the Arizona specimens of this collection.

Holbrookia elegans Bocourt. Mexican Earless Lizard.

Two *Holbrookias* which agree with Schmidt's diagnosis of this form (1922, p. 715) were taken August 3, 1930, in the cholla-sahuaro-octilla desert of the Cañada del Oro, twenty miles north of Tucson.

Holbrookia maculata approximans Baird. Western Earless Lizard.

Our collections of *Holbrookia* tend to confirm the distinctness of

the short-tailed, tubercular-scaled lowland form (*H. m. approximans*) from the long-tailed, flat-scaled form (*H. pulchra*) of higher altitudes as determined by Schmidt (*loc. cit.*, p. 717). All of our specimens of *approximans* from the vicinity of the Huachuca Mountains were taken below 5000 ft.

Localities. COCHISE COUNTY: Mouth of Carr Cañon, lower end of Montezuma Cañon, flat between lower ends of Carr and Ramsey Cañons, Huachuca Mountains; Willcox; Sulphur Springs Valley, twenty miles south of Dos Cabezas. PIMA COUNTY: Cañada del Oro, twenty miles north of Tucson.

Holbrookia pulchra Schmidt. Huachuca Mountain Earless Lizard.

We collected this species in July, 1931, on the Carr Cañon side of Carr Peak at an elevation of between 5500 and 6000 feet. This is the type locality (Schmidt, 1921, p. 1) although a somewhat higher elevation. The species was more abundant than the series collected would indicate for these lizards were very shy, often seeking shelter in deep crevices or beneath large boulders. They seemed more alert and more swift of movement than the *approximans* of the plain.

Holbrookia texana (Troschel). Band-tailed Earless Lizard.

In the sahuaro-ocotillo desert of the Cañada del Oro, we found this species associated with *Callisaurus draconoides ventralis* to which it bears considerable resemblance. It was not as abundant as the latter, however, and even more wary.

Localities. COCHISE COUNTY: Mesquite flats of the San Pedro Valley, five miles east of Hereford; Charleston, thirteen miles north of Hereford; twenty-five miles west of Willcox. PIMA COUNTY: Cañada del Oro, twenty miles north of Tucson. PINAL COUNTY: Campo Boinito, five miles southeast of Oracle.

Uta graciosa (Hallowell). Long-tailed Uta.

One specimen was taken on a dead mesquite log at Well No. 1, six miles northeast of Ajo, Pima County, August 15, 1930.

As the eastern limit of the distribution of this species has hitherto apparently been the valley of the Colorado River (Van Denburgh, 1922, p. 214), the Ajo record extends the known range approximately a hundred miles to the eastward.

Uta ornata symmetrica Baird. Arizona Tree Uta.

We found tree Utas in every locality in which any considerable amount of collecting was done except in the extreme western portion

of the area included in this paper. They occurred at elevations ranging from the desert basins under 500 feet near Ajo to an altitude of over 8000 feet on Carr Peak in the Huachuca Mountains, and in a great variety of habitat associations. The great majority of our large series was taken on rocks and trees but occasionally they were seen on the ground, both in the open and among bushes. Two were found among boards and other debris near abandoned buildings. In the mountains or along boulder-strewn creek beds they were almost always on rocks, in crevices or on the side of a cliff. When in the foothills or lowlands, however, they occurred on the trunks and branches of the oaks or mesquite. We did not observe them associated with any of the cacti but Ortenburger (1926, p. 106) found several on dead cholla in the Cañada del Oro region.

In 1930, between July 19 and August 1, this species was common in all localities visited in the Huachuca Mountains but in 1931, between July 5 and 13, it was very scarce in this locality. Only two specimens were obtained during the second season. This difference in abundance may be accounted for by the fact that the summer rainy season was well under way at the time of our first visit, but when we were there the following year the rains were just beginning.

Localities. COCHISE COUNTY: Carr Cañon, Carr Peak, Montezuma and Ramsey Cañons, Huachuca Mountains; foothills of the Chiricahua Mountains, twenty miles southeast of Dos Cabezas; Turkey Creek Ranger Station, Chiricahua Mountains, thirty miles southeast of Dos Cabezas; San Pedro Valley, ten miles east of Fort Huachuca. PIMA COUNTY: Cañada del Oro, twenty miles north of Tucson; foothills of the Catalina Mountains, twenty-two miles north of Tucson; Well No. 1, six miles northeast of Ajo; Growler Pass, near Bates Well, twenty miles southwest of Ajo. PINAL COUNTY: Campo Bonito, five miles southeast of Oracle; 3 miles west of Superior (Sanders).

Uta stansburiana stejnegeri Schmidt. Southern Brown-shouldered Uta.

Our observations and collections indicate that this subspecies is restricted to the lower foothills and open deserts but not entirely to rocky areas since it was taken in the loose sand country east of Yuma and in the vicinity of Ajo. Although it was perhaps more abundant in rocky places it was found on the ground under bushes, in the branches of mesquite and creosote bush, beneath fallen sahuaros, and running in the open desert trails. It was one of the most common reptiles at Tinajas Altas and on the floor of the Lechuguilla Desert. In that region it usually was more active toward evening than in the early morning and during the very hot part of the day was not mov-

ing about at all. On August 29, 1931, a heavy local storm gave the Tinajas Mountains and adjacent desert a terrific drenching which lasted almost an hour. Within half an hour after the rain stopped, before the sun was again revealed, these Utas came out of their shelters and played about on the wet granite in greater numbers than were seen at any other time.

Localities. PIMA COUNTY: Well No. 1, six miles northeast of Ajo; between Ajo and Bates Well, sixteen miles southwest of Ajo. YUMA COUNTY: Gila Valley, five miles east of Yuma; Ligurta, twenty-four miles east of Yuma; Lechuguilla Desert between Wellton and Tinajas Altas; Tinajas Altas. MARICOPA COUNTY: Mesa (Sanders). We did not find this species in the Tucson region but it was collected there by Ortenburger (1926, p. 107).

Sceloporus clarkii clarkii Baird and Girard. Arizona Scaly Lizard.

That this lizard is in the main a tree-frequenting species has been indicated by Ruthven (1907, p. 538), Van Denburgh (1922, vol 1, p. 363), and others. In the Huachuca Mountains we found it almost always in trees but in the Cañada del Oro usually on or among rocks or on the ground. Of our entire series for both seasons fourteen were found on rocks or in crevices, six were in trees, five were on abandoned buildings and two on the ground. All specimens were taken at low elevations in the foothills and cañon mouths or along the arroyos on the plain.

Localities. COCHISE COUNTY: six miles north of Bisbee; Ash, Carr, and Montezuma Cañons, Huachuca Mountains; plain west of the Chiricahua Mountains, eighteen to twenty miles southeast of Dos Cabezas; "Circle J" Hills, eight miles north of Willcox; San Pedro Valley near Fairbank. PIMA COUNTY: Cañada del Oro and foothills of the Catalina Mountains eighteen to twenty miles north of Tucson. PINAL COUNTY: Campo Bonito, five miles southeast of Oracle.

Sceloporus jarrovii jarrovii Cope. Yarrow's Scaly Lizard.

At altitudes above 5000 feet in the Huachuca and Chiricahua Mountains Yarrow's *Sceloporus* was by far the most abundant reptile. It occurred in almost every type of habitat: on the walls and ledges of cliffs, in crevices, on rocks along the brooks, in rock slides, on trees, fallen logs, abandoned buildings, in heaps of debris and old machinery parts, beneath piles of boards, and on the ground.

On clear days it was nearly always encountered in sunny spots along the trails, the brilliant bluish color of the older individuals making them very conspicuous. On cloudy days or in the early morning it was not so much in evidence but sluggish individuals of a dull

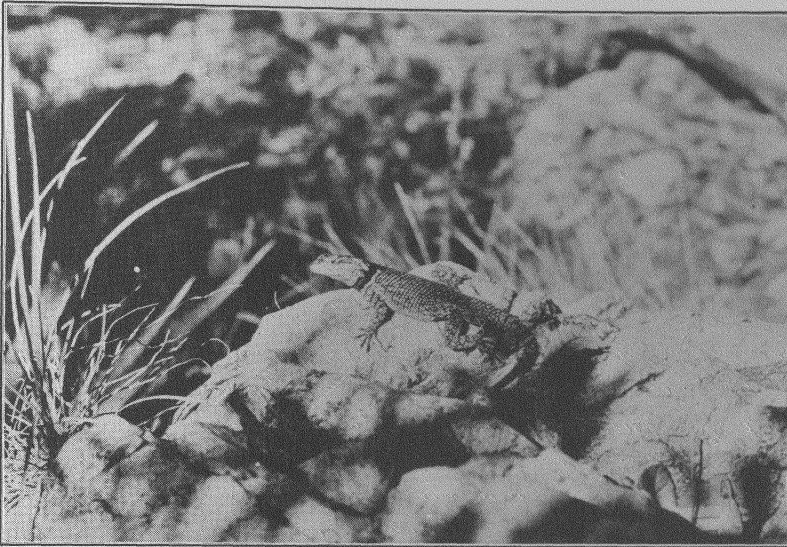


Fig. 13. Yarrow's Scaly Lizard, *Sceloporus jarrovi*, Ramsey Cañon, Huachuca Mountains. This is probably the most abundant reptile in the mountains of southeastern Arizona.

coloration were found beneath loose bark on logs, under stone piles or amid rubbish. Stejneger (1902, p. 151) noted that a marked color change, apparently due to temperature, occurs in this species. This phenomenon, from our observations, occurs only in older individuals and is more accentuated in males than in females. The young are dull colored with no blue except for a pale throat patch.

Because of their lack of timidity and great curiosity these lizards were easily captured by means of a thread noose at the end of a slender stick. When approached with the noose some seized the thread and chewed it savagely, and although somewhat alarmed by attempts to drop the noose over their heads, did not become frightened enough to flee to safety at once but permitted the collector to try again. Those of larger size were more difficult to approach and usually scampered out of reach up the cañon wall if the first trial with the loop was unsuccessful.

On July 30, 1930, in a partly dismantled shed in Ash Cañon, Huachuca Mountains, I watched two approximately half grown *S. jarrovi*, one somewhat larger than the other, fighting or pretending to fight. They sprang at each other with open mouths but neither seemed to receive much, if any, injury. After one of these clashes they separated, faced each other, spread their throat fans widely, and each

bobbed rapidly up and down, raising and lowering its body with its forelegs. The larger apparently tired of this activity and turned to other pursuits while the smaller menacingly followed with open mouth.

Remains of this species were found in the excrement of *Crotalus triseriatus pricei* VAN DENBURGH in the Chiricahua Mountains.

Localities. COCHISE COUNTY: Ash, Carr, Miller, Montezuma, and Ramsey Cañons, Huachuca Mountains; Turkey Creek, Bonita and Ward Cañons, Chiricahua Mountains, all above 5000 feet.

Sceloporus magister magister Hallowell. Desert Scaly Lizard.

With the exception of one individual collected among rocks, we found this large *Sceloporus* only on the floor of the desert. As pointed out by Ruthven (1907, p. 534) and Van Denburgh (1922, p. 336) it is a wary species, usually associated with vegetation, and infrequently seen in the open. In the Lechuguilla Desert we often observed it taking refuge in burrows beneath the clumps of creosote bush before we were close enough for an attempt to secure it.

Localities. GILA COUNTY: three miles northwest of Globe (Sanders). MARICOPA COUNTY: Mesa (Sanders). PIMA COUNTY: Cañada del Oro, twenty miles north of Tucson; Well No. 1, six miles northeast of Ajo; Growler Pass, twenty-one miles southwest of Ajo. YUMA COUNTY: Gila Valley, six miles east of Yuma; Lechuguilla Desert, between Wellton and Tinajas Altas.

Sceloporus scalaris Wiegmann. Orange-sided Swift.

According to Van Denburgh (1922, p. 272) this species is known in the United States only from the Santa Rita and Huachuca Mountains of southeastern Arizona. We secured three specimens, all in the month of July, 1930 and 1931, from the latter region in the vicinity of the Hamburg Mine at the upper end of Ramsey Cañon. All were found beneath boards in a clearing.

Sceloporus undulatus consobrinus Baird and Girard. Striped Swift.

Although collected in several localities in the mountains and eastern plains area, this lizard was not commonly seen except on boulders at the sides of the road to the Turkey Creek Ranger Station in the Chiricahua Mountains. Specimens were also taken on trees and buildings and beneath stones.

Localities. COCHISE COUNTY: Turkey Creek and Ward Cañon, Chiricahua Mountains; Montezuma Cañon, Huachuca Mountains; Hereford; Willcox. PINAL COUNTY: Campo Bonito, five miles southeast of Oracle. YAVAPAI COUNTY: twenty-two miles south of Ashfork.

Phrynosoma cornutum (Harlan). Texas Horned Lizard.

Represented in our Arizona collection by a single specimen obtained by Mr. Doudna at Willcox, Cochise County.

Phrynosoma douglassii hernandesi (Girard). Short-horned Horned Lizard.

Three small examples of this form were obtained in a trail on the north side of Carr Peak, Huachuca Mountains, at an elevation of 6000 feet, July 21, 1930. Another was secured between Campo Bonito and the Bonito Mine, 5000 feet, between five and six miles southeast of Oracle, Pinal County, August 12, 1930.

Phrynosoma modestum Girard. Round-tailed Horned Lizard.

Collected by Mr. Doudna near Dos Cabezas, Cochise County.

Phrynosoma platyrhinos Girard. Desert Horned Lizard.

Five specimens were collected in the Lechuguilla Dessert, Yuma County, between Wellton and Tinajas Altas, August 25 and 28, 1931. They were taken in early morning, late afternoon and after sunset.

Phrynosoma solare Gray. Regal Horned Lizard.

We obtained this horned lizard only in open desert where vegetation was sparse. One was taken near an ant hill and excrement voided before it was preserved contained large quantities of the hard parts of these insects.

Localities. PIMA COUNTY: Cañada del Oro, twenty miles north of Tucson; between foothills of the Catalina Mountains, twenty-two miles north of Tucson; Well No. 1, six miles northeast of Ajo; Bates Well, sixteen miles southwest of Ajo.

Gerrhonotus kingii Gray. Sonoran Alligator Lizard. (fig. 14).

We found no individuals of this species below 6000 feet and six of the eight obtained were taken at 7000 feet or above. Five were found in open grassy areas, two were under boards, one was found dead at the base of a 300-foot cliff, another seen in Ash Cañon, Huachuca Mountains, escaped among the dead lower leaves of a group of sotol plants. These lizards moved with a deliberateness which gave an impression of much less speed than that actually attained and were difficult to capture alive.

Localities. COCHISE COUNTY: Ramsey Cañon, Huachuca Mountains; Turkey Creek and Ward Cañon, Chiricahua Mountains.

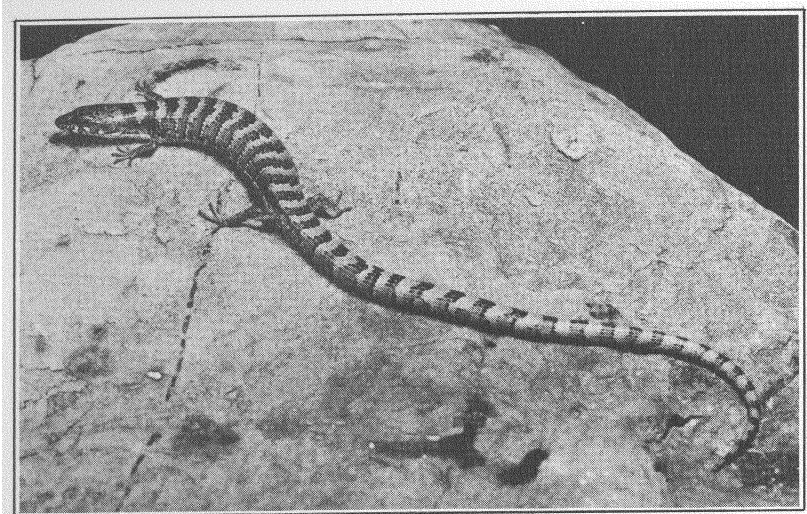


Fig. 14. Sonoran Alligator Lizard, *Gerrhonotus kingii*, a species occurring at elevations above 6000 feet in the mountains of southeastern Arizona.

***Heloderma suspectum* Cope. Gila Monster.**

The Gila Monster was collected in the late evening only, in all cases after sundown. Two were obtained just after a heavy thunder shower. One was found in the mesquite plain of the San Pedro Valley, one on the desert floor near foothills of the Catalina Mountains; another on a rocky ridge in the desert, and a fourth in a sandy arroyo.

Localities. COCHISE COUNTY: San Pedro Valley, ten miles north-east of Fort Huachuca; foothills of Mule Mountains near Don Luis; Sulphur Springs Valley near Gleason (Bowman). PIMA COUNTY: Desert at western edge of the Catalina Mountains, twenty-one miles north of Tucson; west side of Cañada del Oro, eighteen miles north of Tucson.

***Cnemidophorus sexlineatus perplexus* Baird and Girard. Sonoran Whiptailed Lizard.**

The Sonoran "race runner" was one of the most abundant species in the lowland plains and valleys of southeastern Arizona. While it penetrated the cañons of the eastern slope of the Huachuca Mountains it was found only in the cañon floors at elevations below 5000 feet.

In the Huachuca region it was associated with small shrubs and undergrowth, on the plains of the San Pedro Valley mostly with mesquite and creosote bush, near Willcox and Dos Cabezas with desert grass, mesquite and sage brush, and in the Cañada del Oro with chaparral thickets of creosote bush, mesquite, prickly pear and ocotillo.

Extremely large individuals of 200 mm. and greater in length and with a pattern of transverse rows of spots instead of longitudinal stripes were found only in the Cañada del Oro north of Tucson and at Campo Bonito near Oracle. These large examples are regarded by Ruthven (1907, p. 557-559) and by Burt (1931, p. 130) as conspecific with the widely distributed, striped form, and the differences assumed to be due to especially favorable environmental conditions in the Tucson region.

Localities. COCHISE COUNTY: Six miles north of Bisbee; Carr and Montezuma Cañons, Huachuca Mountains; one mile east of the Huachuca Mountains; San Pedro Valley, three miles east of Hereford. PIMA COUNTY: Cañada del Oro, twenty miles north of Tucson; foothills of the Catalina Mountains, east of Cañada del Oro. PINAL COUNTY: Campo Bonito, five miles southeast of Oracle.

Cnemidophorus tessellatus tessellatus (Say). Desert Whip-tailed Lizard.

Although this lizard was abundant in the deserts of Pima and Yuma counties, we took only one specimen in the plains area east of the Huachuca Mountains. It has been recorded, however, from several localities in Cochise County (Burt, 1931, p. 159, 177). To Dr. Burt's excellent summary of the literature on the habitats, behavior and food of this species (*loc. cit.*, p. 188-197) little can be added from our observations. In the Papago Country, however, in the vicinity of Ajo and Tinajas Altas where this species was abundant, we found it quite as frequently in areas of hard-packed soil with numerous mammal burrows as in a loose sand habitat. This seems to indicate that for this lizard loose soil is not an important environmental factor, as some writers have suggested, and supports Burt's statement that this is one of the most plastic of American lizards.

Localities. COCHISE COUNTY: Eight miles north of Willcox. MARICOPA COUNTY: Mesa (Sanders). PIMA COUNTY: Cañada del Oro, twenty miles north of Tucson; on Tucson-Ajo road, forty miles east of Ajo; Well No. 1, six miles northeast of Ajo; five miles southeast of Ajo; Bates Well, sixteen miles southwest of Ajo. YUMA COUNTY: Gila Valley, five to six miles east of Yuma; Lechuguilla Desert, between Wellton and Tinajas Altas; Tinajas Altas; six miles southeast of Tinajas Altas; Wellton.

Eumeces callicephalus Bocourt.

This species has been but recently added to the known fauna of the United States (Taylor, 1929, p. 67-69). We obtained one specimen and saw another at an altitude of about 6400 feet among loose rocks on the north side of Ramsey Cañon (fig. 3), Huachuca Mountains, July 10, 1931. I am indebted to Dr. E. H. Taylor of the University of Kansas for the identification of this specimen.

Eumeces obsoletus (Baird and Girard). Sonoran Skink.

During the month of July, 1930, we collected several juvenile specimens of this skink thought to be young of the previous year. They were beneath stones at an elevation of about 5400 feet in Carr Cañon, Huachuca Mountains. One adult and three young were taken in a stone pile near the Wilcox Ranch house, about two and a half miles southeast of the Huachuca Mountains, on July 30, 1930. This was at an elevation of approximately 4600 feet on the plain sloping toward the San Pedro River.

SNAKES

Heterodon nasicus Baird and Girard. Western Hog-nosed Snake.

A small hog-nosed snake was found in sand beneath a piece of tin on the plain east of the Huachuca Mountains, four miles southeast of Fort Huachuca, July 31, 1930. This species was also taken in the Sulphur Springs Valley, twelve miles southwest of Dos Cabezas, July 20, 1931, and at Willcox, August 19, 1931; all in Cochise County.

Masticophis semilineatus (Cope). Sonoran Whip Snake.

Mr. Ditzler took a specimen of this snake in the lower end of Carr Cañon, Huachuca Mountains, July 22, 1930. It was discovered in the open near a creek and when pursued attempted to enter a crevice under a stone; this failing to give it protection, it climbed into the branches of a small tree. Another was taken August 3, and a third August 5, near the stream in the Cañada del Oro, twenty miles north of Tucson. None of these attempted to rely upon their speed in escaping but sought shelter in the nearest cover.

Masticophis flagellum frenatum (Stejneger). Western Whip Snake.

That the subspecies *frenatum* and *flavigularis* of *Masticophis flagellum* intergrade in southeastern Arizona and southwestern New Mexico has been indicated by Ortenburger in his monograph of the genus (1928, p. 124 and 146). At the time in which his studies were

made, however, very little material from this region was available. Two of our specimens from Cochise County, Arizona (U.M.M.Z. 69668 and 71340), show intergradation in color pattern between these two forms. For comparison of these intermediate specimens with more typical examples of the two subspecies from localities fairly close to the region of intergradation, notes on certain characters are given in table V.

TABLE V. Comparison of Certain Characters in Specimens of *Masticophis flagellum frenatum* and *M. f. flavigularis*.

Specimen	Ventrals	Caudals	General color tone in life	White stripe on loreal	Ventral Pattern	Neck Bands
<i>flavigularis</i> UMMZ No. 69667 ♀ Brewster Co., Texas	198	108	pinkish	—	Very indistinct; brownish; more than 8; fading posteriorly; 1-2 scales wide, separated by 2-4 rows of scales of ground color.	Throat heavily blotched with brown; double rows of spots forming 2 longitudinal stripes on anterior fourth of belly.
Intermediate toward <i>frenatum</i> UMMZ No. 71340 ♀ 20 miles southeast of Dos Cabezas, Ariz.	199	106	red	—	Indistinct; reddish brown; about 8; first 4 more conspicuous.	Faintly and irregularly blotched with reddish brown on throat and first 30 ventrals.
Intermediate toward <i>frenatum</i> UMMZ No. 69668 ♂ 8 miles north of Hereford, Arizona.	193	82+	brown	+	Indistinct; brownish; 8-10, fading posteriorly; 2-4 scales wide, separated by 1 scale areas of ground color.	Distinctly but irregularly blotched with brown on throat and anterior fourth of belly.
<i>frenatum</i> UMMZ No. 69669 ♂ 20 miles north of Tucson, Arizona.	194	92+	brown	+	Very conspicuous; black; 3-5 in number, followed by 4-5 less distinct, brownish bands.	Irregular; distinct black blotches on throat and anterior fourth of belly.

In scutellation these specimens are within the range of variation described by Ortenburger for *flavigularis* in New Mexico and *frenatus* in Arizona. In number of ventrals one (71340) with 199 exceeds the mean (195) for *flavigularis* in New Mexico, while the other (69668) with 193 is close to the mean (194) for Arizona specimens of *frenatum*.

In life the general color tone of No. 71340 was red, approximating that of a red-phase *frenatum* described by Ortenburger (*loc. cit.*, p.

114).* The other was generally brownish, the lateral and dorsal scales with a median dark line which gave the impression of a series of narrow longitudinal stripes more conspicuous laterally. This coloration was noted by Ortenburger (*loc. cit.*, p. 103) in a *flavigularis* from Las Cruces, New Mexico, and in four other specimens from Chihuahua, Durango, and San Luis Potosi, Mexico. Another character in which the Arizona specimens show intergradation is in the loreal white stripe which is present in typical *frenatum* but absent in *flavigularis*. This loreal stripe is possessed by No. 69668 but is lacking in No. 71340. Neither of the intermediates has the black crossbands on the neck typical of *frenatum* although this pattern is approached in No. 71340 by four reddish-brown neck bands of the same shape and position of those of the usual black pattern. Both have a ventral coloration similar to that most commonly found in *frenatum*.

These intermediate specimens furnish definite indications of intergradation between *flavigularis* and *frenatum* in southeastern Arizona. Individuals from southwestern New Mexico should be expected to show a somewhat stronger tendency toward *flavigularis*.

During the afternoon and evening of July 30, 1930, a heavy rain washed out portions of the bank of a highway drainage ditch about three miles east of the Huachuca Mountains. The following morning while repairing the damaged road, Mr. Leslie Wilcox of Hereford discovered a snake egg in the ditch. In the edge of the bank above, eleven inches beneath the surface of the ground, were seven more. They were in a compact mass, not adhering to one another, and all somewhat discolored from contact with the reddish-brown soil. One that was injured contained a young snake about ten inches long. They appeared spoiled a week later and when opened all young were dead. Dark neck bands typical of *frenatum* could be distinguished in some but the pigmentation was not sufficiently developed to determine whether or not any showed evidence of intergradation with *flavigularis*.

The *frenatum-flavigularis* intergrades above described were taken in the following localities in Cochise County: U. M. M. Z. No. 69668, in an abandoned cistern among trash and a pile of adobe bricks, San Pedro Valley, eight miles north of Hereford; No. 71340, coiled within the cavity of a gas engine piston in a ranch building, Sulphur Springs

* That a similar red phase sometimes occurs in *flavigularis* seems not to be generally known. Ortenburger does not mention it either in his description or discussion of that form. A specimen collected by the writer near Pueblo, Colorado (U.M.M.Z. 71787), was decidedly red above and pink below in life. Its color pattern resembled the form with wide dark crossbands ten to fifteen scales in width (Ortenburger, 1928, p. 94), although each of these wide bands was broken up into two to four (usually three) narrow bands separated by two to four scales of ground color. The cross bands were reddish-brown and did not exhibit great contrast with the intervening areas. Ventrally there were two fairly regular red stripes on the anterior third of the body.

Valley, twenty miles southeast of Dos Cabezas. An adult *frenatum* with normal pattern (U. M. M. Z. 69669) was captured August 8, 1930, in the desert near the foothills of the Catalina Mountains, Pima County, twenty miles north of Tucson. A juvenal specimen was taken August 28, 1931, in the Lechuguilla Desert between Tinajas Altas and Wellton, Yuma County, beneath a tangle of prickly pear and creosote bush. A specimen later received was taken at Mesa, Maricopa County (Sanders).

Masticophis piceus (Cope). Black Whip Snake.

Only one specimen of the black whip snake was obtained. It was collected in the Cañada del Oro, eighteen miles north of Tucson, Pima County, August 5, 1930. Another was seen in the same region.

Salvadora grahamiae hexalepis (Cope). Western Patch-nosed Snake.

A small patch-nosed snake, hit by an auto but little damaged, was found in a sandy road on the plain six miles northwest of Hereford, Cochise County, July 26, 1930. Two were collected in an arroyo eight miles northwest of Hereford, July 31, 1930. Both of these traveled over an open stretch of sand with great swiftness. They fought valiantly when captured, striking repeatedly and vigorously. The taking of these specimens about sundown seems to indicate crepuscular or nocturnal habits in this species. Van Denburgh (1922, p. 692) tells of one found partly buried in the sand.

Pituophis sayi affinis Hallowell. Arizona Gopher Snake.

Of a total of fourteen specimens of this form twelve were taken in the southeastern portion of the state. Those found active in the open were collected early in the morning, in the late afternoon or at night. Only two were secured during the hot part of the day and these were under cover. Raking through the pile of brush and cholla joints of a wood rat's house disclosed a gopher snake snugly coiled within the nest. It later disgorged a partially digested *Neotoma*. Another was in an abandoned cistern beneath a pile of debris. With the exception of one taken at an elevation of about 6000 feet in Ash Cañon, Huachuca Mountains, this species was found only in the low-land plains or deserts, and often in or near highways or little-used roads. This appears to be a very inoffensive snake for none seemed to resent capture or handling.

Localities. COCHISE COUNTY: Ash Cañon, Huachuca Mountains; San Pedro Valley, two miles east of Benson; two miles south of Fairbank; five miles southeast of Fort Huachuca; ten miles east of Fort

Huachuca; thirteen miles north of Tombstone; Sulphur Springs Valley, three miles west of Dos Cabezas; twelve miles southeast of Dos Cabezas; ten miles southeast of Willcox. MARICOPA COUNTY: Seven miles east of Mesa (Sanders). PIMA COUNTY: Cañada del Oro, twenty miles north of Tucson. YUMA COUNTY: Lechuguilla Desert, fifteen miles south of Wellton.

Lampropeltis getulus splendida (Baird and Girard). Sonoran King Snake.

A king snake fairly typical of this subspecies was found beneath a pile of boards at the "Circle J" Ranch, ten miles southeast of Willcox, July 19, 1931. Mr. Doudna saw another, thought to be this form, at Willcox.

Lampropeltis getulus yumensis Blanchard. Desert King Snake.

In the western foothills of the Catalina Mountains during the late evening of August 3, 1930, a specimen of this king snake was found among the underbrush of mesquite and catclaw near a small group of cottonwoods at the mouth of a little cañon. The locality is about twenty-three miles north of Tucson on the eastern side of the Cañada del Oro, Pima County. Another was collected, also in the late evening, in the Gila Valley six miles east of Yuma, Yuma County, August 21, 1930.

The Tucson specimen has unusually wide cream-colored bands on an almost black ground color. The crossbands of the one from Yuma are relatively much narrower and less conspicuous and the ground color is dark fuscous rather than black.

Lampropeltis pyromelana (Cope). Arizona King Snake.

This brilliantly colored species was encountered only at high elevations in the Huachuca Mountains. Six specimens, nearly all of which were in the open among rocks on the cañon sides or in the trails, were secured. One was entwined in the lower branches of a small mountain mahogany shrub (*Cercocarpus*) its red, black and cream-colored bands making a striking picture against the smooth red bark with yellowish leaf scars. A large individual seen in a trail in Ash Cañon escaped in a nearby rock slide.

Localities. COCHISE COUNTY: Carr, Ramsey, and Miller Cañons, Huachuca Mountains. PIMA COUNTY: Stratton Cañon, Santa Catalina Mountains, July 29, 1932 (Painter).

Sonora occipitalis (Hallowell). Tricolored Ground Snake.

Our only representative of this secretive little snake was taken

about 9:30 P. M. in the soft sand ridges of the Gila Valley, five miles east of Yuma. Sand trails likely to have been made by this species were much in evidence.

Thamnophis eques (Reuss). White-bellied Garter Snake.

We found this garter snake usually in the near vicinity of water, sometimes swimming in the creeks. An exceptional case was the discovery of one beneath a creosote bush on the dry plain of the San Pedro Valley at least two miles from water.

Localities. COCHISE COUNTY: Carr and Ramsay Cañons, Huachuca Mountains; San Pedro Valley, two miles east of Hereford; Sulphur Springs Valley, eighteen to twenty miles southeast of Dos Cabezas. GILA COUNTY: ten miles north of Payson (Sanders). PIMA COUNTY: Cañada del Oro, eighteen to twenty-two miles north of Tucson.

Thamnophis marcianus (Baird and Girard). Marcy's Garter Snake.

Specimens from Mesa, Maricopa County, were received from Mr. Sanders.

Thamnophis megalops (Kennicott).

Specimens were sent from Mesa by Mr. Sanders who states that this species is not common in that area.

Trimorphodon lyrophanes (Cope). Arizona Lyre Snake.

A specimen collected by Dr. Smith eighteen miles southwest of Ajo (two miles west of Bates Well), Pima County, extends the known range in Arizona some distance westward. It was in a crevice of rock just within the entrance of an abandoned "prospect" on a low granite ridge.

Micruroides euryxanthus (Kennicott). Sonoran Coral Snake.

Mr. Philip Blossom of the University of Michigan Museum of Zoology collected a coral snake in the Agua Dulce Mountains, seven miles east of Papago Well, Pima County, May 17, 1933. It failed to show resentment when carelessly handled by a prospector who insisted that it was a "harmless garter snake."

Crotalus cinereus LeConte. Western Diamond Rattlesnake.

About 8:30 A. M. on July 31, 1930, Mr. Ditzler discovered a rattlesnake of this species in a sheltered recess among limestone rocks near the mouth of Carr Cañon, Huachuca Mountains. As I hurried toward him with a camera, he noticed three small groups of newly-born young coiled within a few inches of the mother. During the

operations involved in setting up a tripod, the little snakes became alarmed and one by one disappeared under the rocks. We did not attempt to restrain them for fear of disturbing the mother who obligingly kept her position, giving only an occasional admonitory buzz, while several exposures were made (fig. 15). We bagged the large snake and moved the rocks in search of the young. They all had entered a short, pocket-like burrow in the ground and the eight secured are thought to be the entire brood. The female (U.M.M.Z. 69736) measured 935 mm. The measurements of the young follow:

	Sex	Total length	Tail length
(1)	♂	280 mm.	25 mm.
(2)	♀	293	21
(3)	♀	295	21
(4)	♂	290	25
(5)	♀	287	21
(6)	♀	288	19
(7)	♀	301	22
(8)	♂	295	25

Another female taken August 3, 1931, by Mr. Doudna near the Dragoon Mountains, thirty miles southwest of Willcox, gave birth to young the following night or next day.

To the good fortune of the collector, snakes sometimes become trapped in smooth-sided excavations, such as ditches, tanks, reservoirs, etc. Such a fortuitous trap was formed by an abandoned cistern in the San Pedro Valley, eight miles north of Hereford. It contained an accumulation of tin cans, corrugated iron, scraps of lumber and a pile of disintegrating adobe bricks. When several stones had been tossed into the pile, the characteristic buzz revealed the presence of a rattlesnake. After considerable digging a medium-sized *cinereous* was uncovered, together with a whip snake, gopher snake and spadefoot toad already mentioned.

Three specimens of *Crotalus cinereous* from southeastern Arizona and southwestern New Mexico exhibit a peculiar pink or reddish coloration, comparable to that of light colored examples of *Crotalus ruber* in southern California. An unusually high degree of erythrism was manifest in a *cinereous* found dead on the highway four miles northeast of Douglas, Arizona, where the soil of the surrounding country is of a reddish brown color. In this individual the head was gray with no conspicuous stripes on the cheeks, the supralabials, infralabials, chin and throat white. The dorsal ground color was salmon pink, deeper in tone posteriorly and increasing in brilliance on the sides. The outer ends of the ventrals showed a decided tinge of pink



Fig. 15. Western Diamond Rattlesnake, *Crotalus cinereus*, in lower Carr Cañon, Huachuca Mountains. Eight newly born young found with this female sought refuge under the rocks.

throughout the length. The dorsal blotches were reddish-brown, not conspicuously distinct, and posteriorly blended almost completely with the ground color. On the anterior half of the body the blotches were separated by short, indistinct white crossbars, the white restricted to the tips of the scales of the five or six median rows. These white bars became darker posteriorly and disappeared entirely on the caudal third of the body. The median portion of the belly was cream color, the ventral side of the tail suffused with pink.

Another specimen taken seven miles north of Willcox shows the same type of coloration but there are traces of stripes on the sides of the head, the dorsal blotches are more distinct, more brown, have white borders both medially and laterally, and toward the tail form crossbands of a deeper tone than that of the ground color. The third specimen of this type was collected by Malcolm V. Parker in the vicinity of Red Mountain, ten miles southwest of Deming, New Mexico. It differs from the two just described chiefly in that there are no white scales separating the dorsal blotches.

Since individuals with the gray coloration usual for *Crotalus cinereus* have been obtained from the same or nearby localities, the significance of erythrism in this species is not clear.

These rattlesnakes seemed to be abroad in the open only in the late evening and after nightfall. Several were caught crossing roads or trails on the plain between sundown and dark. Some were found among boulders near the foothills but none were taken at elevations above 5000 feet.

Localities. COCHISE COUNTY: San Pedro Valley, opposite Carr Cañon, Huachuca Mountains, ten miles west of Hereford; eight miles north of Hereford; two miles south of Fairbank; Sulphur Springs Valley, "Circle J" Hills, eight miles north of Willcox; mesquite flats seven miles north of Willcox; foothills of Dragoon Mountains, thirty miles southwest of Willcox; four miles northeast of Douglas. GILA COUNTY: three miles northwest of Globe; six miles east of Sacaton; fifteen miles south of Payson (Sanders). MARICOPA COUNTY: Gillespie Dam; eight miles northeast of Mesa; twelve miles east of Mesa (Sanders). PIMA COUNTY: Cañada del Oro, twenty-one miles north of Tucson.

Crotalus cerastes Hallowell. Sidewinder; Horned Rattlesnake.

As we were within the range of the sidewinder only in the late summer night collecting was most effective. We saw none during the day. One found between sundown and dark was coiled on the top

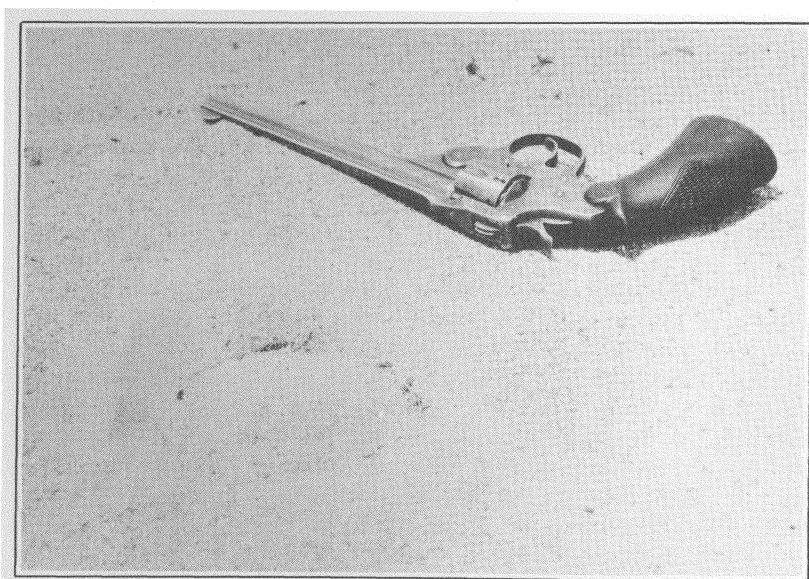


Fig. 16. The imprint made by a Sidewinder, *Crotalus cerastes*, coiled in soft sand. Gila Valley six miles east of Yuma.



Fig. 17. Daytime shelter of a Sidewinder, *Crotalus cerastes*, in the Gila Valley east of Yuma. Note trail leading to the base of the creosote bush on top of the mound (see page 126).

of a sandy mound amid the branches of a creosote bush. When touched with a collecting hook it sprang off the mound and across an open space between bushes at a surprising speed. Another met at night in the road near Growler Pass made no effort to escape.

In the soft sand ridges near the Gila River east of Yuma we frequently saw circular imprints made by a snake coiled in the sand (fig. 16). A sidewinder was discovered one night in such a location. Its compact coil was more than half buried. When first observed it was swinging its head slowly from side to side. Presently it opened its mouth in a wide yawn, erecting its fangs alternately with a stretching motion, just as captive snakes have been observed to do soon after eating. When it was captured no enlargement of the stomach indicated a recent meal but it seems probable that unwary nocturnal mammals may be captured by snakes from such a position of apparent repose. It is unlikely that rattlesnakes engage in active, rapid pursuit of prey. Such behavior in capturing swiftly moving mice or lizards would necessitate a high degree of skill, speed, and a constancy of purpose which they give no indication of possessing. On the contrary, they seem to depend upon the random wanderings of themselves and their prey to bring them within striking distance.

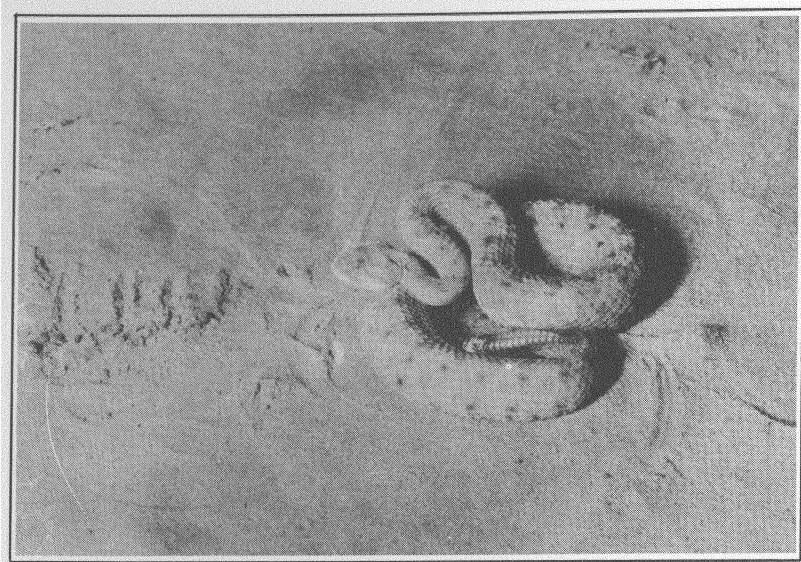


Fig. 18. The inhabitant of the burrow shown in figure 17; a flashlight photograph made about 9:45 p. m.

The possibilities of night photography were suggested by the finding of sidewinders in the manner described and on subsequent trips a camera and flashlight apparatus were added to the usual equipment. On the morning of August 20, 1930, the daytime abode of a sidewinder was located. From the entrance of a burrow in a mound beneath a creosote bush, a very definite sand trail led to the top of the mound (fig. 17). Here it ended in a circular imprint such as those seen in the open sand areas. No trails led down on the other side nor were there any other snake tracks from the entrance of the burrow. The trail from the opening to the summit of the mound had several tracks partly superimposed upon each other, as if the snake had during several successive nights crawled to the top of the mound, passed the night in a comfortable coil, and returned by the same path. We marked the spot with a handkerchief tied to a bush and returned at 9:30 p. m. A new track showed conspicuously on the trail we had examined. This time, however, it led on across the top of the mound, down the other side and across the open sand. Less than thirty yards distant, at the side of a bush, the snake was located. It showed little excitement and remained quiet while the camera was set up and our desire to make a night photograph of this species in its desert habitat was gratified (fig. 18).

In the vicinity of Tinajas Altas in late August, 1931, we did not find this species. Since the region is similar to that of Ajo and Bates Well where we secured sidewinders the previous year, it should be expected to occur, although perhaps less abundantly than in the soft sand dunes and ridges of the Gila and Colorado Valleys. Mr. R. Hale and Mr. O. D. Herron, who operate an auto service station and reptile exhibit known as "Reptile Inn" on the highway between Wellton and Mohawk, told us that sidewinders are abundant in that region. A series purchased from them exhibits a considerable variation in color tone, some having a much darker shade of brown than others. One that we saw in captivity twenty-eight miles east of Gila Bend was unusually dark. Those in our own collection from Ajo where the soil is dark brown were noticeably darker than those from the light colored sandy areas near Yuma. However, as Klauber has recently pointed out (1931, p. 46), this is one of the few snakes in which the color tone apparently varies with changes in the physiological condition of the individual, and differences in intensity of coloration in different regions may have little significance.

Localities. MARICOPA COUNTY: twenty-eight miles east of Gila Bend; ten miles east of Mesa (Sanders). PIMA COUNTY: Well No. 1, six miles northeast of Ajo; Growler Pass, eleven miles southwest of Ajo; twenty-five miles east of Tule Tank (Blossom). PINAL COUNTY: Casa Grande Ruins. YUMA COUNTY: Gila Valley, five miles east of Yuma; nineteen miles east of Wellton.

Crotalus lepidus klauberi Gloyd. Green Rock Rattlesnake.

We found this little-known rattlesnake at elevations above 6000 feet in the Huachuca and Chiricahua Mountains. It occurred in piles of rock along trails or among the great masses of loose stones of the numerous rock slides where the blue-gray or greenish gray color of the snakes harmonized most effectively with the color of their surroundings. Some were sunning themselves on the tops of flat rocks, others were beneath stones or pieces of bark, and two were in the open. All were very timid in behavior, invariably trying to escape and rarely showing much resentment even when pinioned. Sometimes a snake concealed near a trail made its presence known by rattling but the sound was of such slight amplitude that it was heard with difficulty.

Very little appears to be known of the food of this species. Some of our captive specimens ate mice, in some cases with marked eagerness. After striking a mouse in the usual way, one individual followed up its victim, seized it and held it firmly until all struggles ceased, then began swallowing it at once. It seems probable that lizards such as *Sceloporus jarrovi*, which are abundant in the rock slides inhabited

by the snakes, form a considerable part of the food of this species.

As nothing seems to have been published regarding the young of *Crotalus lepidus klauberi*, the inclusion of the following fragmentary notes may be justified. Several green rattlesnakes collected in the Huachuca Mountains early in July, 1928, were sent to me for study by Dr. E. H. Taylor of the University of Kansas. Among these was a gravid female which died in transit and arrived in a badly decomposed condition. It was about fifteen inches long and contained two embryos, one of which measured 160 mm. in length. The egg tooth, now probably to be regarded as a vestigial structure in ovoviviparous reptiles, was present in this individual but small and inconspicuous, scarcely projecting beyond the lower edge of the rostral plate.

Mr. L. M. Klauber of San Diego, California, has permitted me to include here the measurements of a brood of six young in his collection. They were obtained by F. E. Walker and L. H. Cook, July 21, 1930, in Brown Cañon, Huachuca Mountains. All were found close together in a small area and there is little doubt that they were newly born. The measurements made by Mr. Cook follow:

Sex	Total Length, mm.	Tail Length, mm.
♂	207	16
♀	211	14
♀	211	14
♂	214	15
♀	216	12
♀	220	12

Localities. COCHISE COUNTY: Ash, Carr, Miller and Ramsey Cañons, Huachuca Mountains; Rhyalite Park, north end of Chiricahua Mountains.

Crotalus molossus molossus Baird and Girard. Black-tailed Rattlesnake.

In the Huachuca Mountains we obtained the black-tailed rattlesnake at elevations between 5200 and 8000 feet. One was taken in the western foothills of the Chiricahua Mountains at slightly more than 5000 feet. From our observations it was not possible to associate this species with any particular habitat. It occurred on rocky slopes with few loose stones, at the edges of rock slides, coiled in the middle of a trail, in the opening of an abandoned "prospect", on ledges below trails, and on a pile of boards in a shed.

There was little color variation in the series collected. With few exceptions the ground color of adults was brilliant yellow in strong contrast with the deep black rhombs which were conspicuously, though incompletely, bordered with white. In one, however, the rhombs were

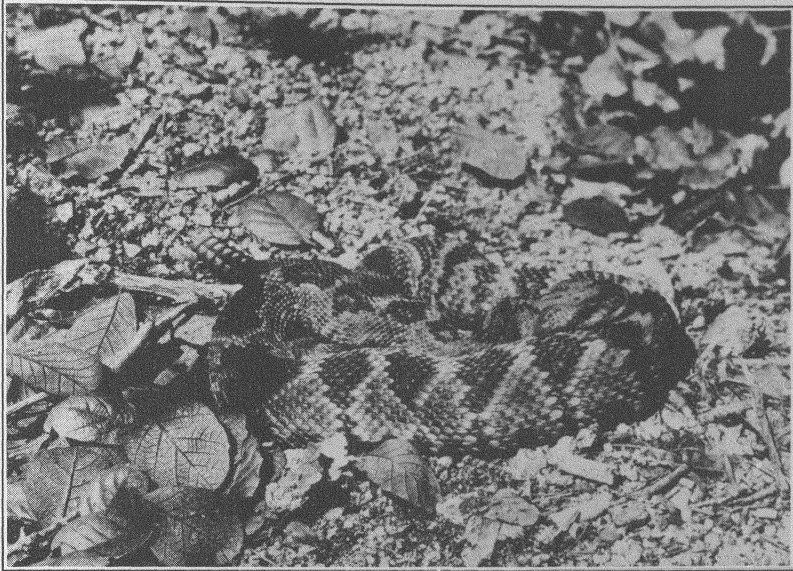


Fig. 19. Black-tailed Rattlesnake, *Crotalus molossus molossus*, in a trail in Ash Cañon, Huachuca Mountains.

brown rather than black, and in a young specimen the ground color was more green than yellow, resembling the general color tone of Texas representatives of this species.

Different field observers appear to have gained varying impressions regarding the general disposition and behavior of *molossus*, some reporting it to be quick, nervous and aggressive and others indicating just the opposite. Only one of those secured by us showed a special tendency toward viciousness. This individual was moving rather rapidly across a mountain slope shortly after sundown and took the offensive as soon as it was disturbed. All others were in a more passive state when encountered. One found sunning itself in the middle of a trail (fig. 19) paid not the slightest attention while several photographs were made at a distance of three feet. When it was eventually disturbed it attempted to escape over the downward side of the trail. Another concealed from view by thick bushes fifteen feet below the level of a trail rattled vigorously as we passed but struggled little when captured.

No observations on the food habits of this species appear to have been published. Some that we sent to the laboratory would eat neither rats nor mice.

Localities. COCHISE COUNTY: Ash, Carr and Miller Cañons, Huachuca Mountains; western foothills of the Chiricahua Mountains near Bonita Cañon, twenty miles southeast of Dos Cabezas; Chiricahua National Monument (Painter). GILA COUNTY: three miles north of Roosevelt Dam (Sanders). PIMA COUNTY: San Diego Cañon, east side of Baboquivari Mountains (Painter). YAVAPAI COUNTY: in the cedar belt of Tusayan National Forest, eleven miles south of Ashfork.*

Crotalus scutulatus (Kennicott). Mojave Rattlesnake.

According to the known distribution of this species, it is a lowland form, characteristic of the plains and desert of the Lower Sonoran Zone. Its range in Arizona includes all of the area south and west of the central plateau. All of our specimens were taken below 4500 feet, in the valleys of the southern and western part of the state. Three were beneath low mesquite trees, two were crossing highways through mesquite country, one was dug out of a mammal burrow, one was found in a sandy arroyo and another in a thick growth of creosote bush.

Klauber (1930, p. 54) states that in Arizona this species ascends to considerable altitudes in the vicinity of Prescott and that specimens from the higher areas are darker, "a deep brown or even black replacing the green of the lowland forms." That this darker coloration may not be restricted to individuals from higher elevations is indicated by a specimen from a mesquite flat of the upper Sulphur Springs Valley, in which the ground color, the centers of the dorsal blotches, and most of the sides are dark olivaceous brown, the usual green showing only in the lighter borders of the blotches and in small, irregular patches on the sides.

The coloration of a specimen found in the Lechuguilla Desert near Tinajas Altas (fig. 20), exhibits a high degree of flavescence. The ground color was bright greenish yellow, with yellowish olive dorsal blotches.

A small individual taken near Ajo, August 14, 1930, may be a young of the year. It measured 250 mm. in total length.

Localities. COCHISE COUNTY: Sulphur Springs Valley, seven miles northwest of Willcox; ten miles east of Willcox; twenty-three miles southwest of Dos Cabezas; seventeen miles southeast of Dos Cabezas; Bisbee (Bowman); San Pedro Valley, eight miles north of Tombstone*; four miles west of Hereford*. GRAHAM COUNTY: Gila Valley, forty-five miles northwest of Safford*. MARICOPA COUNTY: twelve miles east of Mesa; ten miles southeast of Mesa (Sanders). MOJAVE

*Dead on the road.

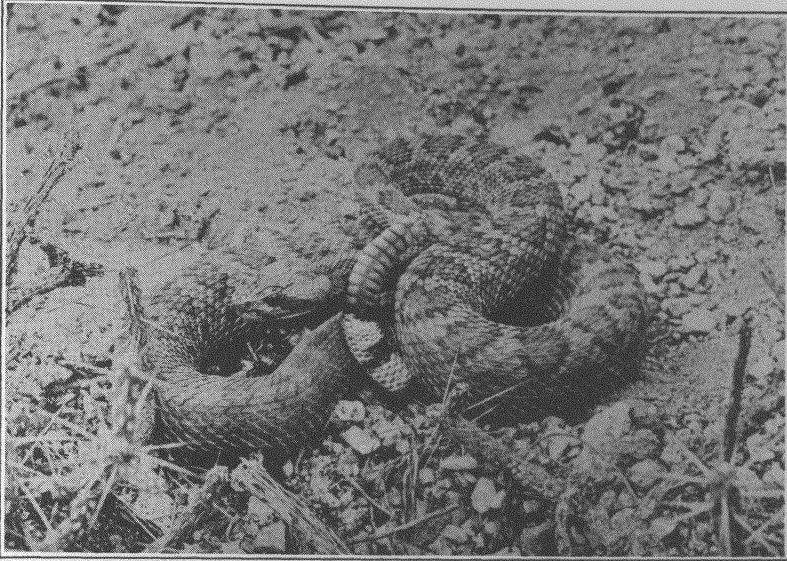


Fig. 20. An unusually flavescent specimen of the Mojave Rattlesnake, *Crotalus scutulatus*, taken in the Lechuguilla Desert near Tinajas Altas.

COUNTY: nine miles east of Kingman. PIMA COUNTY: Well No. 1, six miles northeast of Ajo. YUMA COUNTY: Gila Valley, nineteen miles east of Wellton; Lechuguilla Desert, three miles east of Tinajas Altas.

***Crotalus tigris* Kennicott. Tiger Rattlesnake.**

One specimen of the tiger rattlesnake was taken in the sahuaro-ocotillo association of the Cañada del Oro. It was found by Dr. Smith about midafternoon of August 4, 1930, in the shade of a mesquite tree near a dry arroyo more than a mile and a half from the mountains. It was sent to the laboratory alive and kept for some time. Mice were offered as food but were not eaten.

Locality. PIMA COUNTY: Cañada del Oro, twenty miles north of Tucson.

***Crotalus triseriatus pricei* Van Denburgh. Arizona Spotted Rattlesnake.**

Our diligent search for this species in the Huachuca Mountains was unrewarded but we secured four specimens in the Chiricahua range on August 21, 1931, at an elevation of 7200 feet. The locality (fig. 5) is a high ridge on the western slope near the headwaters of Turkey

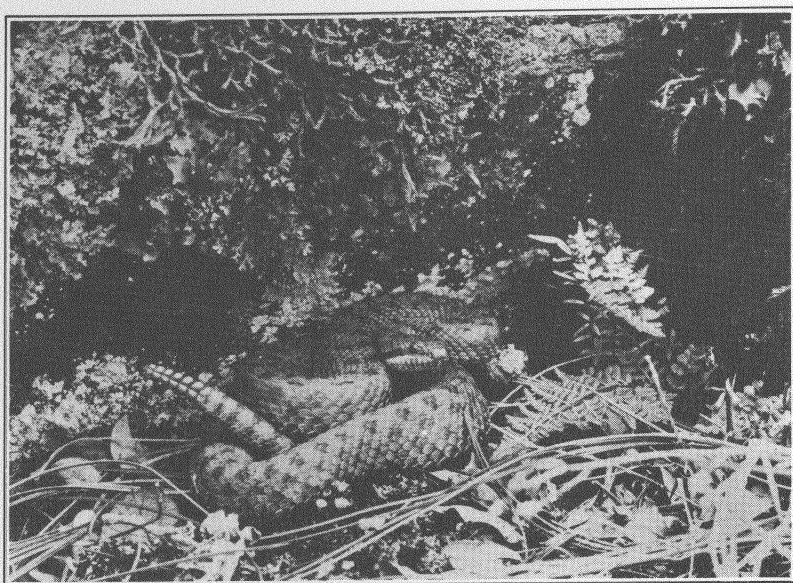


Fig. 21. Arizona Spotted Rattlesnake, *Crotalus triseriatus pricei*. Morse Cañon, Chiricahua Mountains, elevation 7200 feet. (See figure 5.)

Creek in what is called Morse Cañon on the U. S. Geological Survey topographical map (Chiricahua Quad., ed. of 1919) and Mormon Cañon of the U. S. Forest Service map of the Coronado National Forest (1927).

A small individual was coiled in a spot of sunlight on a ledge and another was startled from a bunch of grass. Since the condition of the rattle indicated that they had undergone only the first ecdysis, they were judged to be young of the year. One is 193 and the other 206 millimeters in total length.

One of the two adults was coiled on a horizontal flat stone at the edge of a rock slide. The other was near the crest of the ridge in a shallow crevice among a rich growth of ferns, mosses and lichens (fig. 21).

Remarks of residents in the Chiricahua region indicate that this species is more abundant than ordinarily supposed. Ranchers and members of the Forest Service stated that small rattlesnakes which they called "mountain sidewinders" were commonly met with at higher elevations in many parts of the range.

That this rattlesnake feeds upon *Sceloporus jarrovi*, a very common lizard in the same habitats, was shown by the presence of a large

quantity of scales of that species in the faeces of one of the larger snakes. In captivity no food was taken although mice were offered.

Locality. COCHISE COUNTY: Mormon (or Morse) Cañon between Turkey Creek Ranger Station and Chiricahua Peak, Chiricahua Mountains.

TORTOISES

Terrapene ornata (Agassiz). Western Box Tortoise.

Box tortoises were collected in dry arroyos and on the mesquite plains of the San Pedro and Sulphur Springs Valleys.

Localities. COCHISE COUNTY: four miles east of Hereford; seven miles southwest of Tombstone; eight miles southeast of Dos Cabezas; one mile west of Dos Cabezas.

Gopherus agassizi (Cooper). Desert Tortoise.

A desert tortoise (fig. 22), was taken about 5:00 p. m. in the sahuaro-ocotillo association of the Cañada del Oro, Pima County, twenty miles north of Tucson.

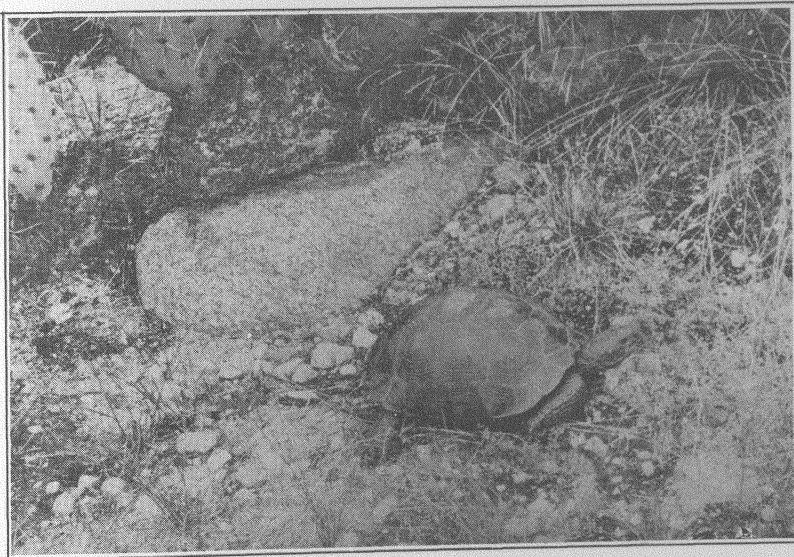


Fig. 22. The Desert Tortoise, *Gopherus agassizi*. Cañada del Oro, twenty miles north of Tucson.

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